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GAS JOURNAL

LIGHT ✦ HEAT ✦ POWER ✦ BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

Vol. CXLII. No. 2869.] LONDON, MAY 7, 1918. [70th Year. Price 6d.

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EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON, E.C. 4.

VOL. CXLII., No. 2869.] TUESDAY, MAY 7, 1918. [70TH YEAR.

EDITORIAL NOTES.

"Financial Hardships" in the Committee Room.

LAST Tuesday saw the beginning of the work of the Select Committee to whom the House of Commons have entrusted the task of considering whether the present extraordinary conditions are such as to justify the financial relief that gas companies are seeking in respect of their statutory conditions of price and dividend. Sir William Middlebrook was appointed Chairman by his colleagues; and he is giving patient and careful attention to the arguments. Up to the close of the sittings on Thursday, Mr. Honoratus Lloyd, K.C., had opened the case for the companies, Mr. W. Cash, F.C.A., had discharged the results of his analytical investigations, and Mr. D. Milne Watson had shown, taking the Gas Light and Coke Company as an illustration, the fearful financial burden that war conditions have superimposed on ordinary conditions, and which burdens under the operation of the sliding-scale have made dividends shrink to a point that is not just to the owners of the capital. Mr. Charles Carpenter, D.Sc., had begun his evidence when the Committee adjourned until to-day (Tuesday). In its broad aspects, the case presented by the promoters is well known to our readers; but the lump sums and analytical data submitted (particularly Mr. Cash's remarkable tabulated statement, which we have reproduced) introduce fresh material into the case for revision.

So far as the cross-examination of witnesses make disclosure, the opponents appear to be relying mainly upon the resurrection of ancient arguments under new conditions —such as bargains, and the dividends on "original" capital, with very little reference to the mass of capital which is not original, or to the premiums paid by holders. That the so-called bargains were made under conditions which have no semblance to those at present existing, is a point that is conveniently lightly passed over; as is also the fact that, in addition to war-produced extra costs for coal of a very inferior quality, for gas oil, and for labour, the Government have largely taken over the control of important tributaries to the revenue of gas undertakings by regulating both dealings and prices, in the interests of the nation. The Government have therefore assisted in the removal of the conditions obtaining when gas charges and dividends were prescribed by Parliament. If the dividends that are being paid to-day are fair to the holders of the capital, then they were grossly unfair before the war, which no sane man will be prepared to assert. Perhaps the opposition will attempt to deal with these knotty points with more fullness when they get their innings.

Solid facts and not platitudes are going to win the Committee's decision; just as they did in the French Courts when the gas undertakings sought the right to charge higher prices than their contract ones. The Courts of our Allies have decided that the war has "completely upset" the equity of gas companies' contracts, and that "it would be altogether "excessive to admit that the terms of the contracts as they "stand can be enforced as though it were a case of ordi-"nary commercial contingencies." [See "JOURNAL," April 2, p. 17.] Every penny of war costs that in this country has come on normal working is something in "excess of ordinary "commercial contingencies;" and every penny of this expenditure is necessary to the rendering of the service to consumers. In the circumstances, no one can fairly argue that gas capital should be unduly deprived of dividends, that the value of the capital should thereby be broken down, and that the industry should be regarded as a seat of investment to be avoided rather than patronized. Why should the gas industry be kept by Parliament in a position inferior to other industries in these respects, because it happens to be under statutory prescriptions designed for peace and not war times, and beyond that under an extra amount of control by the Government, owing to its commodities being of peculiar national importance? This is the question that the opponents have to answer. We await the issue of the present inquiry with confidence that they will not be able to answer it to the satisfaction of a tribunal of men of business capacity, and men animated by a sense of justice.

Modern Carbonizing Work.

"TO-DAY the arts and requirements of war claim every "mental and physical faculty in our being, and enthusiasm "is subdued and controlled by forces outside ourselves." This passage is taken from the introduction to the Presidential Address of Mr. J. H. Brearley to the Eastern Counties Gas Managers' Association; and the address, and all we see around us in the gas industry, are complete contradictions of the second part of the quotation. Instead of enthusiasm being "subdued and controlled by forces outside "ourselves," a great outburst of enthusiasm is provoked by those very outside forces, not only in meeting the claims of war, but in giving most searching examination to various branches of technical procedure in which it has been discovered there is latent potentiality. And the enthusiasm witnessed in effort to bring the hitherto latent potentiality to the credit of the industry's working presents nothing to us which shows any subjugation of it to the claims made by the war upon our mental and physical faculties. The presidential assertion does not apply to Longwood, nor to anywhere else where men have their eyes on the future as well as on the present, unless indolence dominates. At Longwood, continuous vertical retorts have been adopted, and a less number of men are required in the retort-house, and more gas is being obtained per ton of coal. Expensive methods have given place to more economical ones; but all through the address one sees the enthusiasm of the President in inquiry as to how he can do even better than in existing circumstances to improve output per ton.

What, however, is said in the address about Longwood is only fundamental to much that is suggestive. Mr. Brearley, before deciding upon continuous vertical retorts, found it was no easy matter to determine which system of carbonization to adopt; but he has no cause to repent his choice, though using a variety of classes of coal from West Yorkshire. Now new considerations have to be taken into account in making selection of a carbonizing system; and these considerations will cause choice to be even more difficult for some, while others will say that they make the balance go down so much heavier in favour that choice is simplified. Among the considerations is the question of continuous methodical steaming, and the advantages attributed to it, which advantages persist, despite the critics. In company with steaming there have to be considered the independent manufacture of blue water gas, and other proposals that have been submitted to the intellectual judgment of the gas profession. For good combustible fuel gas is what is required everywhere to-day, even for incandescent burners. Calorific value has been pushed on to a lower pedestal, and flame temperature has taken a higher place. The gas profession, too, is looking out for the balance-sheet which will tell them whether the greatest profit per ton of coal is to be found in the challenged high-temperature carbonization without steaming, with its greater yield of benzol products, or by the adoption of vertical retorts, with their graduated temperatures lower at the top with the view to securing the

best return from fuel oils, and greater at the bottom for making, *plus* steaming, the largest volume of gas possible from the coal used—the steaming assisting to prevent the degradation of hydrocarbons, and so resulting in higher makes of gas of a well-maintained quality, both in composition and calorific power. On the other hand, this all means still greater supervision. But the balance-sheet when drawn up will, we believe, show that the extra supervision required by the adjustment of temperatures and volume and pressure of steaming to the character of the coal carbonized, will pay. Though Mr. Brearley on account of location and financial economy does not use nuts exclusively, his observation has led him to the conclusion that the best results are obtainable from them; and that with them the possibilities of steaming are only limited by the quality of the gas that it is desired to produce. This brings into account another consideration, and that is whether after the war the profit attaching to the improved results would not warrant, with certain classes of coal, the adoption of Mr. Thomas Glover's suggestion as to coal washing and grading. Truly, the designation of "gas "manager" has during the war greatly expanded its meaning on the technical side. So far we see no subjection of technical enthusiasm to outside forces, nor any monopoly of mental or physical faculties by the claims of the war.

There is complete agreement with the President's criticism as to the loose methods of stating coke sales and use. The guesswork of our forefathers is so much the mode that prevails that confidence in any returns that are presented has not that stability which should obtain in respect of technical data. It would also be preferable in stating coke sales and use, if the coals carbonized were described, by name—if in no other way. The President submits (again there is agreement) that the question of coke statistics is of sufficient importance for an effort to be made on the part of the Institution of Gas Engineers to secure uniformity of treatment, which should include a more detailed statement as to how the coke discharged from the retorts is disposed of. This is not the first time the subject has been raised, not only by the "Journal," but by Mr. W. R. Herring. While from time to time there has been a little passing interest, the matter has consistently fallen into obscurity. But if in the gas industry we are raising our standards of technical work, then accuracy of statement of results is necessary to reliable comparison and judgment.

Another matter—and this a very difficult one—regarding which Mr. Brearley would like to see some improvement is the making of the "Standard Clauses of Contract" cover more completely the question of guarantees as between the vertical retort contractors and gas undertakings. There are, in his opinion, several points that require amendment or extension. For example, the trial period should, he submits, be extended to a month—seeing that when an installation is new, everything is in favour of high results. There should be no difficulty in this, other than that it would mean that the contracting firm would have for their own protection to keep a man skilled in the operation of the plant in attendance during the whole of the month. "When an in-"stallation is new, everything is in favour of high results." We do not altogether admit that. When an installation is new, some engineers have a tendency to like to experiment with it in all sorts of ways; and experience convinces us that the highest results are not secured at first, but after the plant has been tuned-up. It must not be forgotten, too, that the contractor's reputation—this especially with continuous vertical retorts and their new methods of working—is very much subject to the degree and character of the skilled supervision accorded to the plant which he has left in the hands of the engineer. Mr. Brearley asks for much in the nature of guarentee, while so much is left to the discretion of the engineer in his method of working. For example, we read: "Throughput is linked-up largely with temperatures "in the settings; and a guarantee should not be accepted "unless coupled with the guarantee as to the tempera-"ture in the setting not *exceeding* a determined figure." Is the engineer prepared to guarantee that only a certain class of coal will be carbonized, and that he will so operate the settings that the temperatures will never exceed a pre-determined figure? If the Glover-West system had not permitted of fairly considerable variations in temperatures—some exceeding former normal working—the practice of steaming would not so rapidly have gained the present practical stage. Still we are not disposed to question the contention that there are points in regard to guarantees that could be improved; and Mr. Brearley mentions some of them. For example, he submits that "a maintenance "period based on a given number of months is not satis-"factory. Maintenance guarantees should be based on a "given tonnage throughput per setting." Again, however, this is subject to the speed of the throughput; and speed is a factor that depends not only on coal characteristics, but on temperatures. A fair improvement could be made in the guarantees; but one-sidedness does not mean fairness.

It was a good address—deserving all the encomiums it received at the meeting; and the subjects referred to here do not by any means exhaust those that the President dwelt upon—in fact, the address as published by us is, it is only fair to Mr. Brearley to remark, much abbreviated from the original.

Working a Tar-Dehydrating Plant at Low Temperature.

Under his conditions, in making choice of an intermittent tar-dehydrating plant, Mr. H. R. Wimhurst, of Bury St. Edmunds, did a wise thing. What these conditions were were described in the paper (held over until next week) that he read at the meeting of the Eastern Counties Gas Managers' Association. In the construction of the plant the stills used were converted disused Cornish boilers. But the two chief points of interest about the paper are the character of the crude tar which he had to deal with (he describes it as an "awkward product"), and the low temperature at which he operates the plant. As to the former, when one sees the comparatively high percentage of water in it—10·6 p.ct.—there can be ready agreement as to the tar not being a good one with which to work. This adverse condition would be felt more acutely in a continuous still than in an intermittent one, more especially where the capacity of the condensing coils gave trouble. Naturally with such a percentage of water in the tar, "frothing" and "priming" would be experienced. As to the temperature at which working proceeds, Mr. Wimhurst has restrained it to 110° C., for the reason that the refined product at 150° C. was so viscous that it was difficult to apply it to roads. If this was a difficutly at 150° C., what would it have been like at the 220° C., at which the regulations of the Ministry of Munitions require working, with the object of extracting practically the whole of the carbolic oils for the manufacture of picric acid? Mr. Wimhurst, in other words, confesses that he is working to obtain a saleable refined product, and not working to obtain all that the Ministry requires. He gets benzene boiling at 80° C., and toluene at 110·4° C., but sacrifices some of the xylene and, more important still, the carbolic oils. Very few plants are, it must be admitted, being worked up to the Ministry's requirements—the general tendency being (say) from 195° to 200° C. If Mr. Wimhurst was working at the 220° C., in the analysis the average content of "tar acids" or carbolic oils would most probably have been in the neighbourhood of 10 p.ct., instead of only the 1 p.ct. shown. The benzol (34 p.ct.) and the toluol (15 p.ct.) are high; and 12½ p.ct. of solvent naphtha is good for the temperature at which he works. But it must be noted that the percentage results in solvent naphtha and creosote would not have been so high if the percentage of water had not been so large. We calculate that Mr. Wimhurst is getting 8d. per gallon for his light oils, which is a very good price; but, owing to the low temperature employed, the 5·34 gallons of light oils per ton of raw tar is low. It would be interesting to know the strength of the 19 gallons of ammoniacal liquor per ton of raw tar.

Stresses in Gasholders.

Gasholders do not often receive treatment at meetings of gas engineers; and the cause is not far to seek. Holders are not structures the erection of which engages an individual gas engineer's attention from day to day. As a matter of fact, there are few gas engineers, except those in the larger works, who are ever called upon, or are competent, to design a gasholder. When one is required, the practice is to invite competitive designs. We have before questioned the wisdom of doing this without the protection upon the side of the purchasers of a qualified engineer. Admittedly, gasholder contractors have a large experience, gained under all sorts of conditions; but even gasholder contractors, we believe, would prefer to have some of the responsibility taken off their shoulders by having on the side of their clients a man with complete qualifications for the work. In the paper on "Stresses in Gasholders" that he

read before the North of England Association on Saturday, Mr. Frank H. Robinson makes the point an introductory one, that the problems associated with the gasholder should be tackled in a scientific manner; otherwise a design can well be both wasteful in one direction and weak in another. The problems that are involved are of a highly complicated character—not only on account of one part being rigid and the other part floating, which causes the stresses to vary from hour to hour, but location in respect of subsoil and variable exposure to variable winds also occasion changeable strains and stresses which have all to be taken into calculation in design. But Mr. Robinson is out to instruct on the subject of stresses in holders; and, with freedom, he uses (under due acknowledgment) as a foundation Mr. F. S. Cripps's formulæ and work. In this he could not do better. But when referring to the formula for the stresses in the top curb, he speaks of it as "empirical;" and there seems to be an insinuation that the formula was given to the world bare of proof. The fact is that, far from this being the case, Mr. Cripps's original paper, which forms a chapter in his well-known "Guide-Framing of Gasholders" [pp. 74 to 85], was published at the urgent request of (the late) Sir George Livesey as an example of the way that a formula should be constructed or built-up—starting from the simplest elements. And we know that Mr. Cripps proved everything step by step until the complete formula was evolved. Mr. Robinson properly insists that these problems should be treated in a scientific manner. But in his own paper is the graphic representation of the stresses in figs. 2 and 3 altogether correct? The resultant force is given there as *inclined* to the horizontal, whereas for the forces to be in equilibrium it *must be horizontal* [see p. 80, "Guide-Framing "of Gasholders."] Probably Mr. Robinson has been caught here by fig. 292 in Mr. Alwyne Meade's book, where the resultant is shown inclined simply to avoid overlapping the horizontal forces. Mr. Robinson appears to have overlooked this. We agree with him that "practice without "theory is the cause of much waste and faulty design, and "often disaster;" and that "theory without practice would "result in some weird structures and bad language on the "part of the erectors." We might add that, when either "theory" or "practice" is faulty, it is bad enough; but when both are bad together, it is bad indeed.

High-Pressure Transmission a Matter of Current Importance.

APART from its many technical features, the paper that Mr. Walter Hole contributed on Saturday last to the North of England Gas Managers' Association has a current appropriateness in connection with the work of reconstruction in the gas industry. In the electrical world, there is great talk of interlinking; one object being to eradicate the inefficient small stations, and another to increase the load on the larger and more efficient stations. It is time there was not only more talk, but preparatory action (to be followed up quickly after the war), in regard to interlinking in the gas industry. The tendency to-day is devolution from the larger and already much over-crowded centres. Outlying areas are developing; the advances of transit facilities have contributed to this. Industrial establishments are tending to migrate to the outer districts, and so are the people to whom employment is given by them. This all means that larger quantities of gas are needed in the developing areas, and not only larger quantities, but gas that is cheap relative to the heat energy supplied. This requirement cannot be met by small and independent concerns so economically as by the larger ones (assuming no special adverse circumstances exist in regard to the latter), for by modern methods transmission charges are not a heavy matter. Where such areas are already supplied from an undertaking serving a large centre, prevision is a very necessary quality in the management, with a capacity to discriminate as to the local probabilities. It is highly important to gas undertakings to note the migratory tendency here referred to, and the areas undergoing development; for there is a big reconstruction problem involved. It is also important that the large gas undertakings should—not only in their own interests, but in the interests of areas which they can economically reach, and therefore in the national interests—try to effect amalgamation with the smaller undertakings, which work less economically under their more restricted conditions. The Government to-day are much inclined to look at these matters from a national point of view. "Economy" is a word that now strikes with great force on the ear of the Government. The recent report of the Coal Conservation Sub-Committee on Electricity Supply, as well as the Board of Trade Committee on Electric Power Supply, are evidences of a new governmental interest. The work in other directions of the Reconstruction Committee is of a piece with the rest. The gas industry must not be behind the trend of the times—local and governmental. To ignore it would be an abandonment of duty and self-protection. Therefore underlying the first few crisply stated passages in Mr. Hole's paper, is a great deal that touches immediate and future gas industrial policy.

The remainder of the paper shows how, using Leeds as an apt illustration, high-pressure transmission makes the problem of a proper gas service in outlying districts one of relative ease. The Kirkstall and Rodley districts are in the Leeds gas-supply area; and it is there that the work described has been done by high-pressure means in reinforcing the supply necessitated by local development. But the illustration, and the practice, will apply to a wider set of circumstances, including the annexation or opening-up of new areas. Mr. Hole in these matters is a safe guide. The detail of the work shows a studied economy by making the best possible use of pre-existing conditions—by, among other ways, the conversion of a 10-inch independent main into a high-pressure one, and producing water economies in conjunction with existing compressors by circulating the water through a large battery of tanks, and only having to compensate for the loss by evaporation. The 10-inch independent main had been laid for some twenty years in the ground subject to all the strains and stresses inflicted upon it by traffic—old and modern. That it was originally well and truly laid is seen by the fact that, when a pressure test was applied, it proved quite tight at 35 inches. In this connection an interesting and useful feature is the description of the clearing of the main by air-blast of its two decades' accumulation of corrosion, which under high pressure would have had a rapidly destructive effect upon the governor. There is also a hint worth noting as to the future protection of the governors by steel wire gauze (brass wire gauze too quickly succumbs) from the passing forward of corrosion. Another point is that while the compressors are worked at varying pressures according to demand, in these industrial areas a regular 4-inch pressure to furnaces is given on the outlet of the meters. Mr. Hole's communication clearly has a larger significance than is usually found in papers that treat of high-pressure transmission.

Sulphate Prices for Home Agriculture and Munitions.

Gas undertakings will note from an announcement in another column that a gratifying increase is to be made in the price to be paid to manufacturers of sulphate of ammonia for the season commencing on June 1. There is to be a net average increase in price of £2 7s. 6d.; and, in addition to this, there is a guarantee that makers will be compensated if the prices of sulphuric acid and bags are raised above the present level. We think undertakings will feel disposed to congratulate the Manufacturers' Section of the Sulphate of Ammonia Distribution Committee on the result they have obtained—not, we understand, without a hard fight. Not only is the advance in itself a considerable one, but the guarantee with regard to the prices of bags and acid will give manufacturers security as regards part, at any rate, of their cost of production. The least satisfactory feature of the arrangements made by the Government is the announcement that the price to farmers is to remain the same. Apart from the inconvenience and the enormous amount of work which will be involved to the makers and the Departments concerned in arriving at the necessary financial adjustments, the decision means further inroads into the pockets of the taxpayer for the farmer's benefit. It is true that in the new income-tax proposals an attempt is to be essayed to make the farmer shoulder a small portion of the burden that the rest of the community is bearing. But while the Government are taking from him a few hundred thousand pounds in direct taxation, many millions are being handed to him in the form of indirect doles.

Coal and Gas Rationing Illustrated.

The letter that appeared from Mr. H. O. Carr last week, on the relationship of gas and coal rationing, with a suggestion that householders should be allowed an extra 5000 c.ft. of gas upon

their gas rations for every ton of coal saved, has attracted the attention of not a few gas and coal consumers. We hope the Coal Controller has been similarly impressed; for, truth to tell, he has taken a most unpopular step, and one that in such an immense number of cases cannot be defended from the point of view of either justice or practicability—particularly in respect of justice, in those instances where gas has been adopted for the express purpose of economizing coal. The muddle that has been created is such that we can see, if transgressing consumers are all to be fined, the need for issuing many hundreds of thousands—perhaps the number may reach a million—summonses at the end of the current quarter for disobedience to the new order. The Board of Trade and the Law Courts will, if the threat materializes, be kept busy until some sane scheme supplants the present one. Illustration of the absurd muddle that has been imposed on gas consumers who have been trying to help the Coal Controller by economizing coal is seen in a letter in our "Correspondence" columns. It was received by Mr. Carr from a Clapham householder; and the writer has taken the trouble to ascertain what his consumption of gas and electricity represents in terms of coal used at the gas and electricity works. Is this consumer, who has reduced below his coal rations the consumption of household coal so substantially, and so allowed the coal represented by his gas consumption to be put to better use (for national and other purposes) at the gas-works to be fined or imprisoned if he exceeds his gas ration? The man who says "Yes" deserves a worse punishment.

Will the National Gas Council Move?

The gas industry ought, it seems to us, to be extraordinarily pleased with the publicly expressed dissatisfaction over the gas-rationing scheme; and some strong effort should be made to obtain its amendment. Naturally the body to take up the matter is the Executive Committee of the National Gas Council, with the abstention from participation of any member or members who may look on gas-rationing with favour, for no other reason than that their individual circumstances are temporarily such that it meets with their views. Something of a middle course is wanted if gas-rationing must be persisted in, and that we altogether dispute if gas production is allowed freedom (on which point Mr. A. M. Paddon writes this week, as seen on p. 236), and the burning of coal for domestic use is further restricted, and the coal passed on to gas-works for treatment. Those who are hard hit are not only the people who have hitherto been economical with gas, but those who have installed gas-heating appliances largely in place of coal-heated ones. In these cases, the weather is the real controlling factor; and the weather has lately been forcibly exerting itself to give a rebuff to the gas-rationing scheme.

Experience and Requirement.

As a gas engineer confidentially remarked the other day, after carefully watching his meter registrations, and keeping an eye on the economical use of gas in his household, "There may be an attempted control of gas use, but no Coal Controller or Board of Trade can control the weather," which has lately insisted upon coal or gas consumption for heating. We read into the remark of our friend the gas engineer that the weather had put him on the high road to a condition where he may have to make "explanation" to the authors of the unpopular scheme. Something, we repeat, is wanted in the nature of a middle course, where both coal and gas are consumed—such as the one suggested by Mr. Carr in the "Journal" last week. And where households have abandoned wasteful coal heating for gas heating, benevolent consideration should be given to atmospheric conditions; otherwise it can only mean that these consumers, in order to save themselves, will partially abandon gas and revert to coal, which will make the Coal Controller's position all the worse. It seems such a pity that in cases where gas-fires and other gas-heated appliances are in use, and are saving labour, that they should be thrown out of use, and a return be made to coal. As we said last week, coal and gas rationing should be unified; and gas-heating, for more material reasons than one—labour-saving, high explosives, liquid fuel, and many other things—should, if anything, be favoured. It is for the Executive of the National Gas Council to move with energy and speed in this matter now that the summer is approaching, so as if possible to get, well before the light, warm days are spent, a more practical scheme afloat than the one now existing.

National Electric Kitchens a National Waste.

One thing that should be avoided in this country is waste. But there is a distressful amount of waste going on; and much where one might expect a good example to be set the country. Through the lack of co-ordination of the work of the Government Departments, a tremendous amount of waste exists; and while every department may within its own particular orbit be working with the view so far as its knowledge will permit to do the best possible for its own objects, there are few of the departments that pay any consideration to the question as to whether, by taking some other course, they would not be contributing also to the good of the work of other departments. The partial view, and not the whole view, of national interests predominates, which is against all the economic teachings of most of the Sub-Committees of the Reconstruction Committee. The Coal Controller wants to save coal, the Explosives Department says materials at full tide for high explosives are a matter of great urgency, the Mineral Oils Production Department and the Admiralty say that a greater production of liquid fuel is necessary, the Controller of Food shows intense anxiety that larger crops shall be produced from the home lands, and the Board of Agriculture and the Ministry of Munitions urge a still greater production of sulphate of ammonia for fertilizing purposes. For all these essentials to our national life appeals are made to the gas industry. Both the Coal Controller and the Board of Trade come along and dam the stream of coal supplies to gas-works, and seriously limit gas consumption. On the other hand, the National Kitchens Department of the Ministry of Food permits the equipment of national kitchens with electric apparatus, in the production of the electricity for which an average of about 4½ lbs. of coal is used (equal to, say, 60,750 B.Th.U.), and giving at the terminals in the electric kitchen only 3420 B.Th.U.! Besides the production of this small result, all the things that are required by the Ministry of Munitions, the Admiralty, the Food Controller, the Board of Agriculture, and a host of subsidiary but important essentials, for medical, sanitary, and other use, are destroyed. This is national economy and prevention of waste as known and practised by Government departments with their horizon so limited that they cannot legislate in manner that will render the greatest good throughout the national work. Are the so-called National electric kitchens designed in the national interests or for contributing to national waste? The appeals to the gas industry supply an irrefutable answer.

Fuel Problem in Canada.

The condition at the present time prevailing in Canada with regard to the supply of fuel necessary for the maintenance of the industrial activity of the country, and for the domestic requirements of its population, was considered by Mr. Arthur Hewitt, the General Manager of the Toronto Consumers' Gas Company, in a paper which he lately read before the Canadian Society of Civil Engineers. He pointed to the advantages to be secured by the use of gaseous fuel, and then proceeded to describe a number of the industrial appliances now available. As to the dependence that may be placed upon gas, the author stated that this commodity was first supplied in Toronto during the final days of 1841; and from careful investigation, it would appear that, while there have been local stoppages due to frost, broken mains, &c., there has not been even a momentary interruption to the general gas supply to the city since that date—an excellent record of getting on for eighty years' continuous service. The gas being sent out by the Company is derived from Pittsburgh coal, with the addition of about 40 p.ct. of carburetted water gas. The conviction which Mr. Hewitt emphasized was that each class of fuel available for consumption in Canada should be selected and appropriated for the purposes for which it is inherently and economically best suited—due regard being had to the essential objectives of limiting the necessity for importing fuel from other countries; limiting as far as possible the use of high-grade gas coal to the purposes for which the largest percentage of its efficiency can be usefully employed; and avoiding the use of fuel requiring a long haul, wherever it is possible to secure a suitable substitute requiring only a short haul.

Technical Chemists and the "Lighting Order."—The Registrar of the Institute of Chemistry recently addressed a letter to the Board of Trade, on the subject of the restriction of the consumption of gas and electricity imposed by the "Lighting, Heating, and Power Order, 1918." In reply, Mr. H. C. Honey wrote on April 25: "I am directed by the Board of Trade to state that where consulting, analytical, research, and technological chemists, and teachers and professors of chemistry are able to show that, by reason of their professional needs, they have been unable to effect the economy prescribed by the Order, the Board will accept this as a sufficient explanation under paragraph 14 of the Order."

OBITUARY.

FLETCHER W. STEVENSON.

At the moment of going to press yesterday afternoon, we received with much regret intimation of the death on Saturday, after a short illness, of Mr. Fletcher W. Stevenson, M.Inst.C.E., the Engineer and General Manager of the Coventry Corporation Gas-Works. He had been at Coventry since 1902, when he succeeded Mr. George Winstanley, after having been in practice for some time as a Consulting Engineer. For over eleven years, he was Engineer of the Sheffield Gas Company, which position he relinquished in 1899; and before that time he was Engineer and Manager to the Chester United Gas Company. On going to Coventry, he prepared a scheme for the erection of the entirely new gas-works at Foleshill, from which the supply is now obtained. Next week we shall hope to give fuller particulars of Mr. Stevenson's life work.

The death is announced of Signor GIOVANNI BONN, formerly Manager of the Trieste and Verona Gas-Works, and an Honorary President of the Italian Gas and Water Association. Signor Bonn was born at Verona in 1835.

Second-Lieutenant CHARLES J. W. BROWN, of Charlwood, who was badly gassed on April 18, and died on the 22nd, aged 28 years, was in the service of the Horley District Gas Company for about twelve years. He joined the Army on Aug. 19, 1916, and went to France in March, 1917, as a gunner, R.G.A.; being promoted to Acting Bombardier. He returned to England in May, and was recommended for a commission. In February of this year he returned to France, and was slightly wounded on April 9, but remained on duty.

The death has occurred at Brampton of Mr. CHARLES BOLDRY, an old and esteemed official of the Chesterfield Gas and Water Board. The deceased, who passed away at the age of 71, went to Chesterfield 37 years ago, to take up the position of foreman to the gas and water company, under Mr. C. E. Jones. This position he held till 1895, when the Gas and Water Board was formed, and he was made Manager of the Distribution Department, which office he continued to hold until 1911 when his son, Mr. Charles Boldry, was appointed Distribution Engineer. The services of Mr. Boldry were retained as assistant to his son.

Mrs. RUGGLES, the widow of Mr. C. F. Ruggles, who was Secretary and Manager of the Leighton Buzzard Gas Company, died last Wednesday from pneumonia, after a little less than a week's illness—having survived her husband by about six years. Deep sympathy in their trouble will be felt with the two sons and two daughters, all of whom are connected with the industry in which their father was so well known. Mr. H. G. Ruggles is Manager, Secretary, and Engineer of the Leighton Buzzard Gas Company; and Mr. F. M. Ruggles is Manager of the St. John's (Newfoundland) Gas Company. Of the daughters, Miss L. Ruggles is Gas Cookery Demonstrator with the Darlington Corporation; while Miss M. Ruggles is in the Gas Office at Leighton Buzzard.

Mr. JOHN FURNISS, J.P., the Manager of the Slaithwaite Gas-Works, has unhappily died as the result of the burns he received through escaping gas being ignited by a grate-fire in a trench in which he was superintending the connection of mains. The escape was caused by the bursting of the bladder covering one of the pipes; and Mr. Furniss, who was 61 years of age, was severely burned about the head, face, and hands. He died on Monday of last week from shock. When fourteen years old, he was apprenticed to the Brighouse Gas Manager, and in 1878 became Secretary and Manager of the Slaithwaite works. He was to have retired at the end of the present year. Mr. Furniss was one of the best-known public men in the Colne Valley, having served on the local Urban District Council since 1894, and been Chairman in 1900, 1901, 1910, and 1911, besides holding many other public positions. He leaves a widow, four sons (of whom two are in the army), and three daughters. At the inquest, it was stated that the accident had occurred during the coupling of a 12-in. main from one gasholder to another.

PERSONAL.

At the meeting of the Institution of Civil Engineers on the 23rd ult., Sir HENRY FOWLER, K.B.E., of the Midland Railway, Derby, was transferred from the class of associate members to full membership.

Lieutenant J. A. GOULD (Acting Captain), Rifle Brigade, of the Old Kent Road works of the South Metropolitan Gas Company, has been awarded the Military Cross for distinguished conduct in repelling an enemy night raid.

Mr. P. RICHBELL, JUN., who received his training at the Old Kent Road works of the South Metropolitan Gas Company, and who has been for about five years Assistant Engineer at the Winchester Gas-Works, has recently been appointed to a similar position at Sheffield.

Mr. H. L. BATEMAN, Assistant Manager to the Merthyr Tydfil Gas Company, has been appointed Assistant Manager to the Stretford Gas Company. He received his training at the works of the Ilford Gas Company, as pupil to Mr. W. B. Farquahar, the Engineer and Manager.

Mr. FRED. MOFFLIN, Senior Office Receiver in the Manchester Gas Department, has completed fifty years' service with the Corporation, an event which his colleagues intend to recognize in a fitting manner. Alderman W. Kay, J.P. (the Chairman of the Gas Committee), was on Friday last requested by the Committee to congratulate Mr. Mofflin on his long and faithful service.

In accepting, with deep regret, the resignation of Mr. W. B. LEECH, the Leeds Corporation Gas Committee placed on record their high appreciation of the very able manner in which he has carried out his important and arduous duties during the four years he has held the position of General Manager, with particular reference to the scheme for reorganization and reconstruction of the undertaking.

At the last meeting of the Manchester City Council, the Lord Mayor (Sir Alexander Porter) intimated that he had received a letter from Mr. FRED J. WEST, of West's Gas Improvement Company, Ltd., asking to be excused from attendance at future Council and Committee meetings, on account of his acceptance of the position of Chairman of a Committee set up in Manchester in connection with the output of munitions.

Mr. HENRY B. SKEA, who has for over twenty years been connected with the Arbroath Gas-Works, has been appointed Manager of the Forfar Corporation Gas-Works in succession to Mr. T. W. HARPER, who goes to Ayr. Mr. Skea entered the gas office at Arbroath, as an apprentice, and gradually he worked his way up to the position of Chief Clerk, which he held until seven years ago, when he was appointed Assistant to Mr. A. C. Young, the Gas Manager.

Lance-Corporal J. B. SCOTT, 1/7th Black Watch (Royal Highlanders), the third son of Mr. J. B. Scott, of Cowdenbeath, is a prisoner in a German camp. He joined-up at the outbreak of war, and after eight months of East Coast defence work was sent to France with the first detachment of Territorials, in May, 1915. He has served three years continuously with the "Fighting 51st Division," during twelve months of which he was a sniper and observer, and has taken part in all the actions with his battalion since the Battle of Festubert, up to the great German push of March 21. He is a member of the Eastern District of the Scottish Junior Gas Association.

Mr. W. H. JOHNS, the Engineer and Manager of the West Bromwich Corporation Gas-Works, has been appointed Engineer to the Sheffield Gas Company, to succeed Mr. J. W. Morrison, at a salary of £1100 per annum, *plus* 10 p.ct. bonus. The announcement was made at a meeting of the West Bromwich Town Council last Wednesday, by Alderman J. Brockhouse (the Chairman of the Gas Committee), who observed that he was sure they were all very sorry to lose Mr. Johns, who had been with them for four years. Though they regretted his resignation, they congratulated him upon his success, and wished him well. Mr. Johns, whose management of the West Bromwich gas undertaking has been very successful, received his training as a gas engineer with West's Gas Improvement Company; leaving them to become Assistant Manager to the Bath Gas Company. After seven years there, he was appointed Assistant Manager and Resident Superintendent at the Saltley works of the Birmingham Corporation Gas Department; and later he became Manager of the Malvern gas and electricity undertaking, from which he went to West Bromwich. After the Town Council meeting, individual members warmly congratulated Mr. Johns upon his new appointment.

The Secretary for Scotland has received an application from the Town Council of Hamilton for a Provisional Order under the Calorific Power Standard Act. The calorific power proposed is 500 B.Th.U.

The annual meeting of the Illuminating Engineering Society will be held at the Royal Society of Arts (John Street, Adelphi) on Tuesday next, when there will be a discussion on "The Lighting, Heating, and Power Order (1918), and the Best Methods of Making Economies."

The Institution of Civil Engineers have awarded Telford Premiums to Mr. Alwyne Meade for his recent paper on "Modern Developments in Gas-Works Construction and Practice," an abstract of which appeared in the "JOURNAL" for March 12; and to Mr. G. Blake Walker, for his contribution on "Developments in Bye-Product Coking."

Writing in the "Elektrotechnische Rundschau," Herr B. Schapira says that in the Weissensee-Berlin Gas-Works two batteries of Dessau vertical retorts in blocks of three, side by side, are placed along the two halves of one building. This arrangement is economical in construction and operation. The generator to heat the retorts is alongside each battery; and the regenerator is on both sides of the generator. The triple-retort arrangement is efficient from every point of view. Each set of three retorts is worked as one unit; and the size of the complete battery can be adapted to the needs of the works, and uniform quality of gas maintained at all times. Generator depreciation is much reduced by using a step grate instead of a flat one. Admitting steam at the end of the distillation period gives considerable increase in gas output.

INTERIM INDUSTRIAL RECONSTRUCTION COMMITTEE.

The Government have already expressed approval of the proposals put forward in the Whitley report, that in each industry which has reached a sufficient level of organization there should be established a Joint Standing Industrial Council, consisting of equal numbers of representatives of Associations of employers and trade unions. The Ministry of Labour has been entrusted with the duty of assisting industries in carrying into effect the proposals. A large number of Councils are already in process of formation; but in certain industries, owing to various reasons, progress has been slow. The Ministry of Reconstruction is very anxious that, in the trades and industries in which the degree of organization is not sufficient to admit of the formation at once of full industrial councils, something shall be done. They have therefore promoted a scheme of Interim Industrial Reconstruction Committees, which, it is hoped, will serve as an intermediate stage in industrial organization—a kind of half-way place from which may be considered problems of reconstruction which are of great urgency, and leave for eventual attainment the more permanent status of full Industrial Councils. In a number of trades, the formation of Interim Industrial Committees is already well advanced; but it would speed-up things very much if trades would think over the matter for themselves, and work out the preliminaries on lines which can be found in a "Memorandum on the Organization and Work of Interim Industrial Reconstruction Committees," issued by the Ministry of Reconstruction, at No. 2, Queen Anne's Gate Buildings, Westminster. It is hoped that these Interim Committees will, like the permanent Industrial Councils, not confine themselves to the consideration of subjects specially referred to them by Government Departments, but will exercise a large initiative in devising means by which the transition from war to peace conditions may be most smoothly effected, and the way be opened to the rapid restoration of industrial enterprise. In the memorandum are indicated the most urgent questions to which the attention of Interim Committees should be given. They are the promotion of industrial organization, demobilization and employment, raw materials, priority, financial facilities, new industries, and the disposal of Government stores. On all these subjects, information is given. But other matters of like kind will occur on which the co-operation of trade organizations will be required. We commend to the gas and cognate industries very careful consideration of participation in a scheme which holds within it, if properly worked, much future good.

ELECTRICITY SUPPLY MEMORANDA.

When the gas industry was fighting for the preservation of its rights to develop as it thought best the secondary products arising from the carbonization of coal, it had as its opponents a sort of "secret society" known as the Alkali Manufacturers' Association. But there is a new organization now in existence—an organization of superior and wider constitution—known as the Association of Chemical Manufacturers. Presumably this organization is going to act in the same protective capacity as the old Alkali Association; for they were the petitioners against the gas and residuals conversion clauses that appeared in the Shropshire, Worcestershire, and Staffordshire, the Gloucestershire, and the County of London Electric Power Bills, upon which an editorial article appeared in the "Journal" for Jan. 1 last. In one way, the gas industry ought to be much obliged to the Chemical Manufacturers' Association, because the Bills were proposing a trespass on the territory of the gas industry, which is quite as capable of supplying electrical undertakings with the coke arising from the carbonization of coal or with producer gas made from the coke on the lines suggested the other week by Mr. W. Chaney, as they are themselves—in fact better, for the gas industry is already in possession of a very considerable part of the equipment that is required, and it only means an extension of their operations, and not the establishment of an entirely new system of carbonizing and bye-product developing plant. So far, however, as the chemical manufacturers are concerned, the position of the Electric Power Companies named and that of gas undertakings is totally distinct. The former were proposing an innovation, which is not an integral part of electricity generation, distribution, and trading; the gas undertakings are established, and dealings in and the treatment of their secondary products are matters directly affecting their and the nation's economic interests. This is a vast distinction. However, our "Parliamentary Intelligence" last week showed the lines the chemical manufacturers took in their opposition to the proposals of the Electric Power Bills. The opposition was successful. The Gloucester Bill has been dropped, and the promoters of the County of London Bill have undertaken not to manufacture on the site scheduled in the Bill any bye-products of coal or other minerals, or electro-chemical, electro-metallurgical, or atmospheric products. The clause dealing with gas, residuals, and chemical products in the Shropshire Bill has been deleted. The electricity industry will remark that it was not the gas industry that opposed, but the chemical manufacturers, who seem to have, as the gas industry has found, extraordinary influence in the House, though they are not statutorily controlled in the same sense that gas and electricity undertakings are. Therefore, if the electrical papers have anything nasty to say about this set-back to the aspirations of some electrical men, they had better say it to the right people, and not let their venom fly in the wrong direction.

Chemical Manufacturers and the Electricity Industry.

Preserving the Rights of a National Scheme.

Perhaps the events referred to in the preceding paragraph will assist in a business *rapprochement* of the electricity industry with the gas industry, which would constitute the latter the fuel suppliers to the former. A little consolation for the defeat of the Power Company's proposals will be found by those who have visions of a big national scheme of electricity generation, in the fact that the Board of Trade are asking for a clause in the Power Companies' Bills, providing that the authority obtained under them shall not be allowed to prejudice any national scheme of electricity supply that may be evolved on the lines of the Coal Conservation Sub-Committee's report. On the other hand, there are many electrical men who are earnestly praying that the country and the electricity industry may be delivered from anything approaching the recommendations of the Coal Conservation Sub-Committee. It is to be hoped that no Government Department will be so short-sighted as to father any such scheme, before they have thoroughly investigated whether there are any other courses open which will also further the cause of fuel economy, and thus assist other industries. The problem of electricity supply does not stand in a position of complete isolation from all else. It is inter-related to other problems, and to the general interests of the nation. It must not be forgotten, too, that there are some unkind people who think that masterful influence is traceable in the report of the Coal Conservation Sub-Committee, and that it is anticipated that the same influence will be discovered later in the report of the Board of Trade Committee.

Dearly Purchasing Coal Economy.

Mr. Ernest Hatton, the Engineer of the Newcastle-on-Tyne Corporation Tramways and Electricity Undertaking, is a man of strong convictions and analytical powers. He has brought the latter to bear upon the Coal Conservation Sub-Committee's report on electricity supply; and the result has persuaded him that the literal statements therein are not likely to be realized by the scheme outlined. Those responsible for the report have had swollen ideas, which have little solid ground upon which to stand; and therefore the beautiful financial edifice that was constructed regarding a national scheme of electricity supply, Mr. Hatton is well convinced, is doomed to failure. The report pictured a saving of 55 million tons of coal a year by the adoption of a national electric power scheme. The North-East Coast is a special case of opportunity and utilization, and so has wrongly been taken in some quarters as typical of what ought to be throughout the country, which is quite consistent with the funny little ways some people have of hoodwinking powerful others who possess less knowledge of the subject than themselves. The critic does not believe that all the available waste heat would lead to the saving of more than some 750,000 tons of coal per annum, which would be a very small fraction of the 55 million tons of coal promised. He estimates that an expenditure of 210 millions sterling would be required on the suggested national electric scheme. Calculating the total capital charges at 8 p.ct., Mr. Hatton estimates a standing charge of £16,800,000 per annum to set against a saving of £27,500,000 in coal. Administration, wages, rents, rates, taxes, maintenance, stores, &c., might well represent an additional outlay of £11,200,000, varying according to the conditions of the time. He admits the possibility of saving a very large quantity of coal per annum by modernizing power supply; and, in his opinion, the major part of this saving is to be realized by the conversion of plant from coal to electricity at the seats of power use—that is to say, in works, factories, collieries, &c., and not by the expenditure of millions of money in addition upon super-stations. Coal economy can be purchased too dearly. But given conversion at the seats of use, and the modernizing of the existing power stations, there seems, in order to gain coal economy, little need, as we understand Mr. Hatton, for the fantastic flights to super-stations made by Messrs. Merz & Co. of the Coal Conservation Sub-Committee. We have not the time for conundrums; and so leave to any others less pressed Mr. Hatton's inquiry: If, as stated in the report, the Power Companies in the North-East Coast area took sixteen years to attain the position of supplying one-fifth of the country's present output, how many years at the same rate of progress must elapse before we have reached the saving of 55,000,000 tons of coal per annum?

The Electrical Coal Economists.

The electricians are striving for a place in the sun in connection with coal economy; and they are telling householders they can do marvels in this way, if the householders will only condescend to allow them. Chairmen of electricity supply companies have made a point of this, always avoiding to inform householders of the much better use to which gas-works can put coal than they can do themselves. The "Electrical Times" tells of how the adoption of electric cooking has

saved coal in two households. The kitchen range is a very inefficient servant, and has an enormous appetite for coal. But the coal-heating grate shows far better manners. One of these households used for cooking 1780 units of electricity in the year to June, 1917; and the coal consumption was brought down from 9 tons 15 cwt. to 5 tons. Allowing 10 p.ct. loss in distribution, the 1780 units required for their generation 1 t. 15 c. of coal—the actual consumption per unit being 1·99 lbs. (say 2 lbs.). Now 2 lbs. of coal will develop some 27,000 B.Th.U.; and, allowing 20 p.ct. heating efficiency, the householder would get in useful work out of this coal, used in a modern coal-grate, with its 20 p.ct. efficiency, 5400 B.Th.U., compared with only 3420 B.Th.U. from the unit of electricity, assuming 100 p.ct. efficiency—an assumption sometimes made for a joke. The 1780 units at 1d. would cost £7 8s. 4d.; and a consumer would lose heavily in heat value. The 1 ton 15 cwt. of coal burned at the generating station (the efficiency of the generating plant must be high in comparison with the ordinary run of plant if it requires only 1·99 lbs. of coal per unit) would develop, by the 1780 units delivered to the consumer, 6,087,600 B.Th.U. But no electric cooking appliances render to the user 100 p.ct. efficiency. The same coal used direct by the householder would have given him 10,584,000 B.Th.U.—that is, 20 p.ct. of the potential heating energy of the coal. However, the electrical people claim a saving of 3 tons of coal in this one house, though the total expenses were much about the same, if 1d. per unit be the charge, while the householder lost considerably in heating value. Conversion of the coal to electricity is less efficient thermally than if used direct in a domestic fire grate. The household in question must on the evidence of these figures have been very prodigal in the use of the coal. Nothing is said in our contemporary as to the better value derivable from gas, nor is the fact mentioned that at the gas-works the ton of coal gives about ½ ton of coke in addition to the gas, and a variety of other products essential to our national life—war, industrial, and domestic.

National Kitchens on the Tramway.

Alderman C. F. Spencer, the Director of the National Kitchens Committee, is a bold man. He has visioned National Kitchens on wheels—motor bus and tramcar. Notwithstanding the fearful delays which sceptics of the tramcar idea pictured would befall tram passengers with a National Kitchen on the rails ahead dispensing the good things cooked therein, he, as Chairman of the Tramways Committee of the Halifax Corporation, is trying the experiment on the Halifax lines. Perhaps the people of Halifax will prefer the National Kitchen to the punctual service of the tramcars. This remains to be seen. There is another novelty about this moving installation. The electric-cookers on the tramcar that has been fitted up are supplied with current direct from the 500-volt overhead wires. Electricians are wondering how the heating elements in the electric-cookers will stand the heavy strain of 500 volts in a moving kitchen running on war-worn rails. It is thought that the conditions will put the manufacturers on their mettle. Probably the elements will have to put on metal, and have their efficiency somewhat altered.

A Labour, Gas, and Electric Demonstration.

Darkness brought home to the electricity consumers of Dundalk the fact that labour was strongly against conscription in a large part of Ireland, though applied to other parts of the United Kingdom. There was a general "down tools" day to demonstrate the fact; but what irritated the Dundalk electricity consumers beyond measure was the demonstration made by the gas-works that, while labour was showing its power and registering its protest by not working, they were quite capable of keeping their consumers fully supplied with gas for lighting, cooking, heating, or any other needed service. The Dundalk electricity consumers who think it fashionable to use an eyesight impairing light were envious of their more fortunate gas-using neighbours. The gasholders were their protection; the Electrical Engineer (so the Chairman of the Electricity Committee says) thought it would not be safe to leave the supply on the storage battery without an attendant. No doubt he was right and wise; but what is the capacity of the Dundalk storage battery? The Dundalk electricity consumers know now there is little margin of safety in electricity—that they are subject at any time to the vagarious moods of generating and distributing plant, and men.

The late Alderman Alfred Nuttall, J.P., for many years Chairman of the Blackburn Corporation Gas Department, and an ex-Mayor, left £344,640, of which £227,034 is net personalty.

At last night's meeting of the London Section of the Society of Chemical Industry, Mr. J. S. G. Thomas, B.Sc., of the South Metropolitan Gas Company, was to read a paper on the "Principles and Applications of Hot Wire Anemometry."

Special rings are made by Herr F. Raschig, of Ludwigshafen-on-Rhine, for use as filling material in washing-towers, &c. The rings, which provide large surface, are in the form of hollow cylinders, the height of which equals the external diameter. The claim advanced is that rings or tubes of these proportions have no tendency to lie in any particular direction, so that they rest in the tower in all manner of positions. The path of the gas or liquid may be a hundred times the height of the tower; and the back-pressure is low.

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.

Meeting at Newcastle-on-Tyne.

The Annual Meeting of the North of England Gas Managers' Association was held last Saturday afternoon at the offices of the Newcastle and Gateshead Gas Company. In the unavoidable absence of the President (Mr. Richard Nelson, of Hull), Mr. NORMAN S. COX (the Vice-President) presided.

LETTERS OF REGRET.

The CHAIRMAN read a letter from the President, expressing his regret at not being able to attend the last meeting of his year of office. Mr. Nelson concluded: "The year now closing has been one of happy associations; and I will always look back upon it with glad recollections—my one regret being that I have not been able to finish off as I had anticipated. I have tried to do my best for the Association, and I trust the members are satisfied with my rather poor efforts."

Other letters apologizing for absence were read from Mr. Frank P. Tarratt, Darlington, Mr. H. E. Bloor, York, Mr. W. B. Farquhar Ilford, and Mr. J. H. Brearley, of Longwood.

FINANCIAL STATEMENT.

The HON. SECRETARY (Mr. Herbert Lees) presented the financial statement, which showed that the year's income had been £109 11s. 5d., and the expenditure £102 1s. 11d.; leaving a credit balance of £7 9s. 6d. The assets of the Association amounted to £266 5s.; and the balance at the bank was £67 5s. 6d.

The balance-sheet was adopted.

NEW MEMBERS.

The following candidates for membership were confirmed:

Members: Mr. James Serginson, of Tantobie, Durham; Mr. R. H. M'Gregor, of Cleator Moor; Mr. T. W. T. Hammerton, of Hull; Mr. John Denham, of Whitehaven; and Mr. Walter Frost, of Annfield Plain. Associate: Mr. William Wallace, of Hull.

DONATION TO THE INSTITUTION BENEVOLENT FUND.

On the proposal of the CHAIRMAN, it was agreed to make a donation of £10 10s. to the Benevolent Fund of the Institution of Gas Engineers. The contribution was the same as that given by the Association last year.

PAPERS READ.

Papers were contributed by Mr. FRANK H. ROBINSON, of Harrogate, on "Stresses in Gasholders" (see p. 227), and Mr. WALTER HOLE, of Leeds, on "Reinforcement of District Supplies" (see p. 230).

VOTES OF THANKS TO AUTHORS OF PAPERS.

Mr. A. H. BAGSHAW (Sunderland) moved, and Mr. H. H. COLLETT (Leeds) seconded, a vote of thanks to the readers of the papers; and this was accorded.

Mr. ROBINSON and Mr. HOLE acknowledged the thanks of the meeting—the latter saying that one of the chief values of a paper was that it helped to clear one's own views and clarified one's thoughts. Though Mr. Hole had been a member of the Association for two or three years, this was the first time he had attended one of the meetings; and he was rather glad his first appearance among them should be as the contributor of a paper. He felt it was a duty incumbent upon every member to put his thoughts, opinions, and suggestions into the common stock, for the good of all the members.

OFFICE BEARERS.

The HON. SECRETARY presented the Scrutineers' report on the election of officers for the ensuing year, as follows:

President: Mr. Norman S Cox.
Vice-President: Mr. Harold E. Bloor.
Committee: Mr. A. W. Branson and Mr. H. H. Collett.
Hon. Secretary and Treasurer: Mr. Herbert Lees (re-elected).
Hon. Auditor: Mr. W. Garbutt (re-elected).

Mr. COX and Mr. LEES returned thanks.

Votes of thanks were heartily accorded to the retiring President, to the Committee, and to the other officials for their services in the past year.

A JUNIOR SECTION PROPOSITION.

Near the close of the meeting, it was mentioned by the Hon. Secretary that it was proposed to form a Junior Section of the Association, and that matters to this end were to be considered.

Detinning Process at Birmingham.—At a meeting in Birmingham of the National Salvage Council, recently formed at the request of the War Cabinet, the Lord Mayor (Alderman A. D. Brooks), who presided, announced that 600 tons of old tins were collected annually from the refuse of Birmingham. They were submitted to a detinning process by Mr. C. M. Walter, the Analytical Chemist in charge of the new research laboratory of the Birmingham Gas Department, and the result was that £300 per ton was obtained for the tin, and £7 per ton for the scrap steel. Mr. David Currie, the Director-General of the National Salvage Council) stated that Mr. Walter had made improvements on previously known methods for detinning; and these improvements would render the task comparatively simple.

EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.

Half-Yearly Meeting at Peterborough.

During war time, several of the meetings of the Eastern Counties Gas Managers' Association have been held in London. But the President for this year (Mr. J. H. Brearley) determined that, although present railway facilities would not allow of a well-attended meeting at Longwood, the spring meeting should again be in the heart of the eastern side of the district. This was done; the meeting being held last Thursday, and a good attendance, considering all things—war limitations chiefly—justified the selection of Peterborough, which city has not been visited now for some time. The Angel Hotel was the meeting-place; and the members were first entertained to lunch by the Chairman and Directors of the Longwood and Slaithwaite Gas Company. The Vice-Chairman of the Company (Alderman Benjamin Broadbent, C.B.E., M.A., J.P.) was in the chair; and on his left-hand side was the President. Among the guests were Alderman D. H. Redhead, J.P. (Chairman of the Peterborough Gas Company), Alderman J. T. Miller, J.P., Mr. A. J. Paten, Mr. Arthur Swallow, and Mr. Edward Adams. Mr. John Barton, the Engineer of the Peterborough Company, was also present and active in helping to make the meeting a success; and, during the morning, he had some of the early visitors looking round his works.

After the lunch and the loyal toast,

Mr. H. R. Wimhurst (Bury St. Edmund's) submitted the toast of "The Longwood and Slaithwaite Gas Company." He expressed the members' appreciation of the kindness of the Chairman and Directors of the Company in extending their hospitality to them that day. The Company was one of the most progressive and successful in that pushful County of York. The Directors had shown their interest, hope, and confidence in the gas industry by recently erecting an entirely new gas-works, under the advice and plans of their Engineer, the President of the Association. This was a plucky and brave step for them to take in these war times, when material, labour, and everything else was so difficult to get, and so costly when obtained.

The toast was heartily drunk.

Alderman Broadbent, on behalf of the Chairman and his other colleagues on the Board of the Longwood Gas Company, remarked that he believed he was the oldest member of the Board, having been continuously upon it for upwards of forty years. In that length of time, he had seen a good many of the vicissitudes of the gas industry. It had gone through many crises; and he had also known of the great variety of circumstances associated with its advancement. He should have been very glad if he could have devoted the whole of his energies and time, and such abilities as he happened to possess, to the development and promotion of the gas industry, because it always seemed to him to possess such enormous potentialities. With the advent of the electric light, it was thought by some people that gas was on the eve of extinction; but there had been greater development than ever of the gas industry. He could not believe one good thing would ever entirely supplant another good thing. A good thing when once established was capable of infinite development. With reference to the extension of their own undertaking, this was due to their Engineer (Mr. Brearley), and his strenuous efforts to keep abreast of the most modern improvements. But he (Mr. Broadbent) must claim a little credit for the Board of Directors, who had always been willing to investigate all suggestions made to them by Mr. Brearley. The Board had by no means been a *non possumus* sort of Board. They were willing to be led when they considered they were being led in the right direction. It was of the functions of a board of directors to be willing to learn, to be instructed, and to adopt the directions which were to the good of the undertaking which they had under their charge. Despite the adverse conditions of the moment, he believed there was a great future before the industry. One of the things they had to combat in this world was waste. Waste was a weakness. In the gas industry, there had been development of what were waste products, and they were now important commodities. From all that he saw, he believed there was more development to be made in, and more money to be got out of, the industry's secondary products. Proceeding, he proposed "Success to the Eastern Counties' Gas Managers' Asscciation." Both he and his fellow Directors were pleased the Association had elected Mr. Brearley to be their President. He wished the members collectively and individually every prosperity.

The President said they were much obliged to Mr. Broadbent for his able speech. He had certainly stimulated their thinking faculties with regard to the gas industry; and they would derive inspiration from it. He emphasized how true it was that his Board had always taken the keenest interest in everything put before them, and had always adopted a progressive policy. There were many engineers who suffered because they had not a Board as good as his own; and he always sympathized with those engineers. Continuing, he proposed the toast of the "Peterborough Gas Company," coupling with it the name of Alderman Redhead, the Chairman. In the course of his remarks, the President referred to Mr. Barton as one of the pillars of the Association. To him he was personally grateful for the interest he had taken in the arrangements for the meeting.

Alderman Redhead acknowledged the toast, and spoke of the many changes that had occurred since the Association last arranged to meet in Peterborough.

BUSINESS MEETING.

The Business Meeting was shortly afterwards held, the President (Mr. J. H. Brearley) in the chair.

Confirmation of Minutes.

On the motion of the Vice-President (Mr. H. R. Wimhurst, of Bury St. Edmunds), seconded by Mr. John Barton (Peterborough), the minutes of the last meeting were taken as read.

Letters of Apology.

The Hon. Secretary (Mr. F. M. Paternoster, of Felixstowe) next reported that he had received letters of apology for non-attendance from the President of the Institution of Gas Engineers (the Right Hon. Lord Moulton), from the President of the British Commercial Gas Association (Sir Hallewell Rogers), from Presidents of other District Associations, and from Mr. Thomas Glover and other members of the Association.

New Members.

Mr. J. H. Troughton (Newmarket) proposed, and Mr. G. R. Casterton (Melton Mowbray) seconded, the election of the following gentlemen as members: Mr. J. C. Wright, of Romford; Mr. H. J. Carpenter, Assistant Manager, Peterborough; Mr. Samuel Moore, of Scunthorpe; Mr. J. R. Bradshaw, of Retford; and Mr. H. Banyard, of Haverbill.

Annual Report and Accounts.

The annual report and accounts were next presented. The former reviewed the proceedings of the year, and concluded with the following items:

The year commenced with a membership of 123. During the year four new members and two associate members were elected, one member resigned, and one terminated his connection with the Association under Rule 19. The Committee regret to report the death of two members—Mr. W. D. Child, of Romford, and Mr. J. B. Fenwick, of Retford. The total membership at the end of the year was 125.

The following members of the Association are known to be on active service: C. W. Church, of London; J. F. Davis, of Gravesend; J. Ratcliffe, of Alford; G. W. Richmond, of Leighton Buzzard; and C. W. Thomas, of Stourbridge. The Committee report with great pleasure that the D.S.O. has been awarded to Captain G. W. Richmond, and the M.C. to Lieut. J. F. Davis. The Hon. Secretary would appreciate the assistance of members in keeping this record complete.

The accounts show a balance in the hands of the Hon. Treasurer at the end of the year of £26 14s. 5d. The subscriptions received amounted to £68 5s.; and the expenditure to £62 3s. 2d. The balance brought forward from last year was £20 12s. 7d. The increase in the amount carried forward is principally due to the reduction of the arrears of subscriptions, which are much lower than in the previous year, and to payments in advance for 1918.

The Committee have decided, in consequence of the increased cost of printing, to abandon the separate issue of the transactions of the Association, and that instead members will be supplied with a bound volume of the "Reports of Gas Associations," published by Mr. Walter King. The charge for the volume will be 5s., payable on application to the Hon. Secretary.

The Commercial Sections have met as usual; and the Committee feel that the value of the work done at these meetings in the interest of the industry cannot be too strongly impressed upon the members.

The President remarked that from the reports and accounts the members would notice that the Association had had a somewhat busy year, and a somewhat expensive year. There were one or two items in the report which would come before the meeting separately. One was in relation to the subscriptions payable by the members.

Mr. J. Terrace (Grimsby) moved the adoption of the report.

Mr. Troughton seconded the motion; and it was adopted.

Increase of Subscriptions.

Before the adoption of the accounts was moved, it was thought convenient to deal with the proposed alteration of the rules.

The President moved—

> That owing to the greatly increased cost of prin ting and other expense of the Association, also to the increase from £5 5s. to £10 10s. of the Affiliation Fee payable to the Institution of Gas Engineers, it is advisable, in order to satisfactorily carry on the work of the Association, to revise the annual subscription payable by members and associate members as follows: All members representing undertakings having a sale of gas of 25 million cubic feet or less per annum shall pay a subscription of 10s. 6d. per annum, and all other members and associate members shall pay 15s. per annum, and that Rule 17 be amended accordingly.

Mr. Terrace seconded the motion.

Mr. Troughton said he was not averse to the rules being altered in the slightest degree, in order to increase the subscriptions. But, on referring to the accounts, he found the balance in hand was £26. Seeing that one of the largest items of expenditure—printing of the annual proceedings—was to be done away with, he asked whether, in these times of strain or stress, it was necessary that the subscriptions should be increased. He did not personally object to an increase. But he did not think they wanted to pay excess profits at a time like this, especially when they had £26 in hand.

The President remarked that, although they were reducing the amount of printing, still the aggregate cost of it would be as high as, or higher than, it was before. In addition to this, the Institution of Gas Engineers were raising the affiliation fee from 5 to 10 guineas. The additional 5 guineas represented about 1s. per member. In addition, there were many more conferences to attend in London in connection with the National Gas Council, which involved entirely new items of expenditure. It was unfair that members attending the meetings of the National Gas Council should pay their own expenses; and the Committee thought these expenses should be paid by the Association. To attend the National Gas Council meetings, the Committee had elected Mr. Townsend, of Colchester. The expenses of the Committee also fell upon the Association; and there was 50 p.ct. increase in railway fares. The Committee met no more than was necessary—in fact, they had only met once since the last general meeting. The Committee were unanimous that the alteration was necessary in the interests of the Association. It was felt, however, that it would be a hardship upon the managers of the smaller undertakings to pay the increased rate of subscription; and this was the reason why the Committee had limited the increase to members representing undertakings with a sale of 25 million cubic feet and upwards. Incidentally, he thought it

would be worth while the Institution of Gas Engineers considering a gradation of subscription.

A MEMBER: They are doing so.

Mr. CASTERTON considered that this was not the time to raise subscriptions. It would, he thought, shut out a good many managers of small works. Most of the members, too, were members of the Commercial Sections; and most of the members had to pay railway fares to attend the meetings. They met practically monthly. He thought there would be a hardship in raising the subscription, unless the increase applied only to managers of works of 100 millions and upwards, instead of 25 millions and upwards.

The HON. SECRETARY remarked that there was one thing Mr. Troughton had overlooked. Quite an unusual number of members had paid their subscriptions for 1918 in advance; and this money was included in the balance forward on Dec. 31 last. Therefore there would not be so much money to collect for 1918. With regard to the expenses for attending the meetings of the National Gas Council, he did not know whether it was understood by the members that the Executive Committee met fortnightly. In sending up Mr. Townsend from Colchester, they were represented at a very moderate expenditure. As to the "Reports of the Gas Associations," these were going to be issued at the nominal figure of 5s. a copy; but they would cost the Association more than this.

Mr. H. WIMHURST (Sleaford): If every copy bought by the Committee is taken up, the cost, I understand, to the Association will be some £6?

The HON. SECRETARY: Yes. We have only arranged to buy a limited number.

MR. WIMHURST said he should support the Committee, seeing that the proposal only applied to members representing undertakings having a sale of over 25 million cubic feet.

The proposed alteration of the subscription was adopted.

THE ACCOUNTS PASSED.

Mr. TROUGHTON, in moving the adoption of the accounts, said, of course, it would be understood that he was not raising a discordant note in referring to the alteration of the subscriptions. His point was only as to the policy of the proposal at the present time.

Mr. H. WIMHURST seconded the motion, which was carried.

INAUGURAL ADDRESS.

The PRESIDENT then delivered his Inaugural Address, the main parts of which were as follows:

These are not the days for verbiage; and when I say "Thank you" for the honour you have done me in electing me your President, the paucity of words must not be taken as the measure of my appreciation. In addressing you to-day, I cannot help contrasting the state of affairs with what prevailed when, as President I addressed the Manchester District Institution eleven years ago. Then, a man's energies were solely directed to the arts of peace; and a gas manager derived an infinite amount of pleasure from his vocational ties, and always met something that compensated him for his enthusiasm in any specific direction. To-day, the arts and requirements of war claim every mental and physical faculty in our being; and enthusiasm is subdued and controlled by forces outside ourselves. "Duty" is the alpha and omega of our creed, and so must continue until we arrive at emancipation day, and destroy for ever the menace of fetters that would bind us to the gospel of force. I had hoped that by the time this chair was reached circumstances would permit the Association to have one of its old-time two-day gatherings and pay a visit to Longwood Gas-Works. This is impossible, as matters are. You may be assured that your President will heartily welcome any member who wishes to see the new works which have been erected. A description of these works appeared in the "GAS JOURNAL" for July 31, 1917, and in the "Gas World" for July 28, 1917; and I do not now propose to deal further with the constructional aspect.

AMALGAMATION OF THE LONGWOOD AND SLAITHWAITE GAS COMPANIES.

When the Longwood Gas Company and the Slaithwaite Gas Company amalgamated in 1914, one of the factors which operated in bringing this about was the need at each manufacturing station of greater and more economical carbonizing plant. The relative position of the two areas and gas-works is shown diagrammatically on the accompanying plan. If we had continued under our former expensive methods of manufacture, the wages advances would have affected, approximately, three times the number of retort-house employees on the works to-day; while each extra cubic foot of gas obtained from the coal is a greater asset both to gas undertakings and to the nation than it was prior to the war.

CHOICE OF A CARBONIZING SYSTEM.

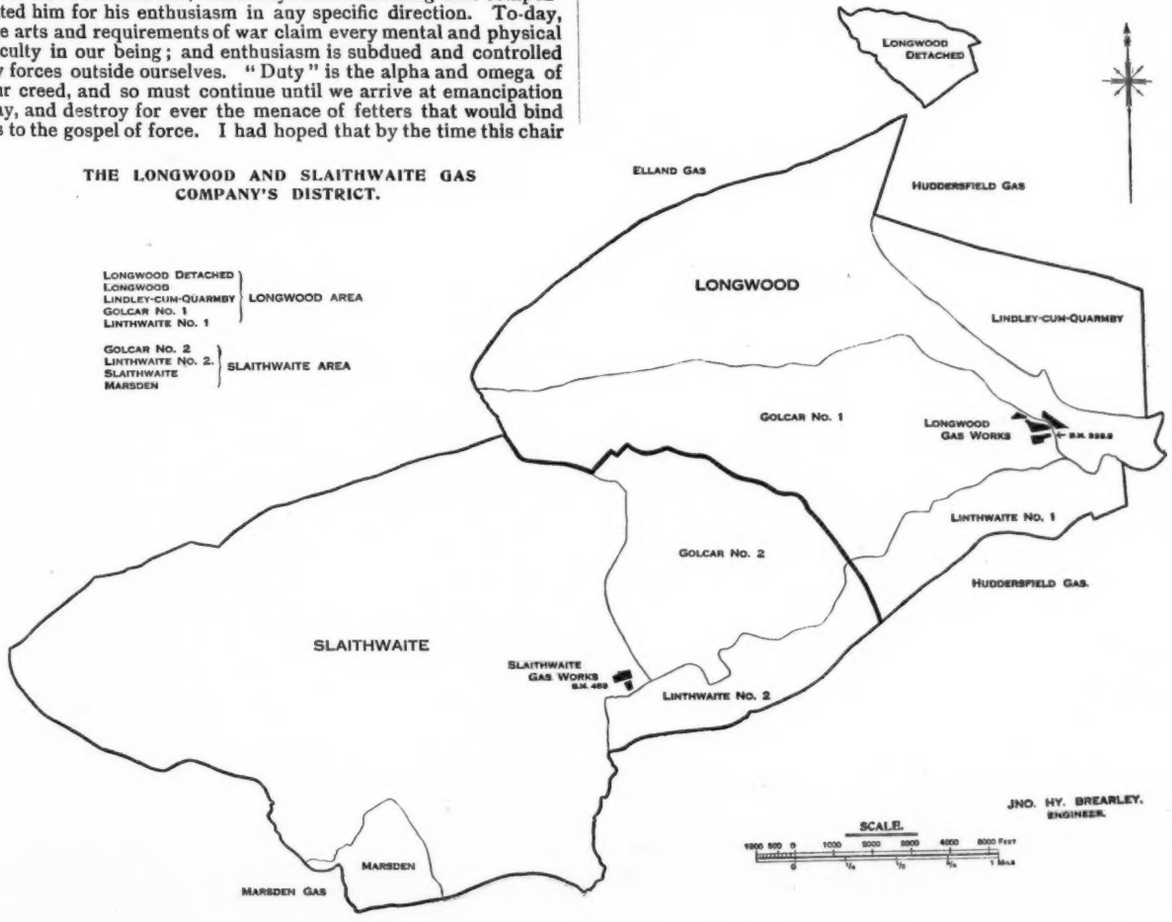
It was no easy task to determine which system of carbonization to adopt. Upon the point of labour costs, verticals appeared to rightly claim the advantage. Another question which did not seem to have been satisfactorily solved was as to the greater extent to which verticals called for selection, due to the physical and other characteristics of the coal used. Through the courtesy of Mr. Tim Duxbury, of Oldham, we sent some trucks of slack to the Central Gas-Works, Oldham, for experimental carbonization. Two retorts were worked for several days on this material without any trouble whatever; an assistant from Longwood being present during this period. Under our hand-charged system, slack gave the most economical results; and we were loth to adopt a system which would entail its abandonment.

A third leading question which called for settlement was as to whether the coke produced would be acceptable to the chief consumers of our coke output. Accordingly, the coke from the test was sent to our largest user, a wire-drawing firm, taking about 16 p.ct. of our output. Their verdict was entirely favourable. The wire-drawing process is one calling for careful regulation and control of heats; and we had no hesitation in accepting this as favourable to verticals, especially as the coke supplied for trial was produced from the cheapest grade of coal then being carbonized at the Longwood works.

SOME POINTS IN VERTICAL RETORT WORKING.

Starting.—The first few weeks of a vertical installation is a

THE LONGWOOD AND SLAITHWAITE GAS COMPANY'S DISTRICT.



critical period for those in control. The men have to become thoroughly accustomed to a vocation entirely alien to what they have hitherto been familiar with, the regulation of the mechanism which controls the rate of flow of the coal has to be carefully adjusted, the heat distribution which best suits the characteristics of the coal being carbonized has to be determined, and, generally, both time and caution are of the essence of success. Where practicable, it is a good plan to send the men to be employed to have a few days' preliminary training at a works already operating verticals.

Make of Gas and Coal Used.—Working results cannot yet be given over a full year. During the first half of 1917 we were closing-down the old works, and more or less feeling our way. For the six months ended Dec. 31 last, the results have been good; but we cannot pretend that they are yet up to the best of which vertical retorts are capable. On a coal carbonization of 7945 tons, the make of gas was 111,230,000 c.ft., averaging 14.000 c.ft. per ton, of an average calorific value of 541 B.Th.U. gross, giving a multiple of 7,574,000 per ton of coal. Parenthetically it may be observed that the quantity of coal used in the six months was less by upwards of 3000 tons than in the corresponding period of 1916, although more gas was made; so that in this regard the installation was doing excellent national work. The coal used is entirely West Yorkshire, which, generally speaking, is not up to South Yorkshire in quality. We have had nine varieties of coal from seven collieries, and have not been able to exercise any pretence of selecting, mixing, or averaging in any way the deliveries from the station to the coal-hoppers. We have experienced very little trouble indeed from hanging-up; and on this score it would be difficult to imagine a more severe test than the mixed nature of the deliveries with which the installation has been fed.

Steaming.—From the first starting of the plant we have admitted steam, though test runs with particular classes of coal for a sufficiently long period have been impossible. We are more or less bound to the collieries with which we did business under hand-charging conditions. So far as our observations go, the best results from verticals accrue from using suitable nuts, when the possibilities of steaming appear to be mainly limited by the quality of gas it is desired to produce. As we are working, the probability is that at times we are admitting too much steam for the particuiar class of coal passing through, and at other times less than we might do with advantage. We have to aim at a convenient satisfactory mean; and this we find to be admitting steam through $\frac{1}{8}$ in. nozzles at 35 lbs. pressure. The steam is not superheated; but the pipe traverse from the boilers is very short, and is covered with non-conducting material.

Coke Sales.—As regards the screened coke sales, these for the six months have only averaged 8·2 cwt. per ton of coal carbonized. This figure has been affected by the following factors: (1) Part drying of beds that were not worked before June 30; (2) coke used for conversion into water gas, and extra coke required for heating the settings in consequence; (3) drier condition of coke sold as compared with horizontals; (4) necessity of allowing ample stand-by ready for gas making, as all the output depends upon verticals; (5) all the power required is derived from breeze-fired boilers, and includes (*a*) electrical generating set for conveyor, hoist, and retort mechanism, (*b*) exhausters, (*c*) compressors for sending Slaithwaite gas requirements, (*d*) all the usual pumps, (*e*) rotary washer, (*f*) sulphate of ammonia plant, and, in winter, steam required for gasholder lutes and one set of water-lute purifiers. With the exception of the first item, these factors are permanent. The published figures of our coke sales vary enormously. If we take the "Gas World Analysis for 1916," for example, we find that the coke and breeze available for sale ranges from 6·1 cwt. at Portsmouth to 13·7 cwt. at Chester and Nuneaton. I am no more disposed to accept the one than the other as a fair representation of coke sales as generally understood. There are seven undertakings which purport to sell over 12 cwt. of coke. In such cases the figure cannot represent coke actually sold or saleable after proper adjustment of stocks. Where water gas is made in a separate generating plant from the coal-gas installation, it is usual, I believe, to charge the water-gas plant with the coke used, and to credit the coal-gas plant accordingly. With this procedure no exception can be taken, as it certainly brings coal gas production into fairer comparison. I hope, however, that it will never lead those who steam in verticals taking it as a precedent for charging the carbonizing or gas-making account, as distinct from the fuel account, with an estimated quantity of coke for water-gas production. Again, some managers credit coke sales with an estimated figure for coke used on works other than heating settings. This practice enables them to produce a more favourable figure of coke saleable. I do not condemn or praise the practice; but I do submit that the question is of sufficient importance to merit an effort on the part of the Institution of Gas Engineers to secure uniformity of treatment. The wider adoption of dilution, as distinct from adulteration, renders it more than ever necessary that the coke saleable aspect should be satisfactorily dealt with. In his paper read before the Manchester District Institution of Gas Engineers in October last, Mr. J. E. Blundell recommended that, as regards fuel consumption in heating retorts, a statement be made in terms of energy expended in the form of heat to obtain a given output of available energy in the gas, coke, and other products. For thermal comparisons, this would no doubt be very useful. It would be a step forward if Statement H of the statutory form of accounts prescribed by the Gas-Works Clauses Act, 1871, was amplified by introducing the subdivisions: (*a*) Heating retorts, (*b*) water-gas manufacture, (*c*) steam raising, (*d*) other purposes. Reference will show that column 4 is distinctly headed "sold during year;" and any coke which is included that is not actually sold is, in my view, not in correct compliance with the Statute. Where a gas-works is entirely dependent upon verticals, with its comparatively larger unit, for its output of gas, the quantity of fuel used for heating the settings will be greater than where the verticals form but a portion of the carbonizing plant. In the latter case, the verticals are, or should be, worked at their maximum productive capacity—stand-by being provided in the horizontals. When verticals are solely relied upon, judging by our experience up to date, the quantity of coke used is appreciably greater than with horizontals, unless risks are taken, which no wise manager will indulge in if avoidable.

Tar.—The production of tar during the six months was at the rate of 12·9 gallons per ton of coal, or 1½ gallons above the average for the previous five years with hand-charged horizontals. We are therefore a long way behind some of the figures which have been obtained by utilizing the steaming process; but the coal used does not at present lend itself to full scope with the latter.

Scurfing.—At Longwood the retorts over a period of six months have been scurfed on an average after 22 days' working, and have been off gas-making for an average period of 36 hours each time. The working period could have been extended; but with plenty of retort power we have preferred, with our many grades of coal, to anticipate hanging-up, which is often an indication that retort-scurfing is necessary. Assuming retorts are scurfed every four weeks, and are off gas-making for 36 hours, to which has to be added the period when the retort is being emptied and refilled, about 7 p.ct. of the retort-making capacity is disqualified. Horizontals in this respect certainly have an advantage over verticals. We have the same labour staff both summer and winter, when not more than 16 retorts are at work—*i.e.*, four settings. If the fifth setting is at work, the same men receive extra pay. There are three men on each shift of eight hours, including the foreman of his shift, and a day man to attend to scurfing and the hydraulics. There is also a man on each shift attending to boilers, exhausters, pumps, &c. Thus, the retorts proper take ten men; but we allocate the wages of boiler attendants to carbonizing—making a total of 13. One man attends to the coal supplies from carts into breaker, and thence to the coal-stores or storage bunkers; and his wages are debited to "cost of coal." During the six months the minimum week's make with this staff was 2,846,000 c.ft. the maximum 5,725,000 c.ft. On a vertical retort plant, the greater the proportion of water-gas made, the higher will be the figure of carbonizing wages per ton of coal passed through; so that, for comparison with horizontals, such figures lose their potency, and gas made is the more reliable basis for comparison—ours for the six months being 2·25d., including boiler men.

Heat Regulation.—To obtain the best results and ensure freedom from working troubles, it is imperative that the heats should be carefully regulated. The temperatures, chimney draught, alterations, &c., are recorded in a Heats Book daily. An actual page of the book is given [see p. 225].

Contract Guarantees.—In my view, the "Standard Clauses of Contract" are not sufficient to cover the question of guarantees as between the vertical retort contractor and the gas undertaking. A few points may be referred to in confirmation of this. The "date of completion" needs amplification. Clarity is required as to whether the "guaranteed capacity" is actual or only nominal. This should include an allowance for scurfing periods. A "trial period" of not less than one month should be adopted for determining not merely the capacity, but also the yield per ton, fuel costs, calorific value, and so on. When an installation is new, everything is in favour of high results; and an undertaking which merely bases its estimates of size of plant upon the figures of a two or three days' run when the plant is new, may find itself seriously awry with its estimates. The "quality of coal" should be clearly specified, and the percentage of ash and moisture it should contain, with a predetermined basis of adjustment for *plus* or *minus*. A gas undertaking might find it impossible to get deliveries suitable if the ash content specified was fixed at a low figure. Throughput is linked-up largely with temperatures in the settings; and a guarantee should not be accepted unless coupled with a guarantee as to the temperature in the setting not exceeding a determined figure. The steaming process introduces a further factor. Obviously, the fuel consumption will be higher with the use of steam, and "make per ton" must necessarily be linked with fuel consumption in the furnaces. As regards the "design of a setting and the materials used," too much care cannot be exercised in placing the responsibility upon the contracting firm for the maintenance of stability, since they are almost invariably the designers and the suppliers of the materials. All the tests required to determine whether a guarantee is or is not fulfilled should run concurrently—that is to say, the fuel make and capacity guarantees should be taken conjointly. A maintenance period based on a given number of months is not satisfactory. Maintenance guarantee should be based on a given tonnage throughput per setting. I do not pretend to exhaust this question of guarantees; but from information obtained from many sources, I realize the need for ventilating it.

GASHOLDERS.

There must be a growing degree of concern as to what will be the condition of the gasholders when the war terminates, and how soon thereafter repairs can be effected. Circumstances have

Temperatures, Wednesday, February 20, 1918.

[Pyrometer, Féry.]

Retort No.	Readings 8 a.m.			Remarks.	Readings 5 p.m.		
	Left.	Right.	Average.		Left.	Right.	Average.
19	1270	1300	1285				
17	1320	1310	1315				
15	1310	1300	1305				
13	1300	1280	..	Off for scurfing			
11	1330	1320	1325	Reduced top waste-heat damper ¼ in.	1310	1320	1315
9	1330	1330	1330	,, ,, ,, ,, ,, ¼ in.	1280	1320	1300
7	1250	1320	1285	Increased bottom L.H. damper 1½ in.			
5	..	..	..	Off			
3	1310	1320	1315				
1	1300	1310	1305				
2	1320	1320	1320				
4	1300	1310	1305				
6	1310	1320	1315				
8	..	..	..	Off			
10	1280	1290	..	Off for scurfing			
12	1310	1340	1325	Reduced S.A. auxiliary damper R.H. back			
14	1290	1280	1285	Increased top waste-heat damper ¼ in.	1300	1320	1310
16	1300	1310	1305				
18	1340	1300	1320	Reduced bottom waste heat L.H. 1 in.			
20	1300	1300	1300				
			16)20,940				

1309° C. average temperature.

Retorts.

Working.	Scurfing.	Off.
16	Nos. 13, 10.	5, 8

Chimney Draughts in Hundredths of 1 In.

Setting No.				
5	4	3	2	1
46	52	45	46	45
47	54	46	47	46

compelled many to face emergencies as best they may. During the summer of 1917, our three-lift holder, having a capacity of half-a-million cubic feet, developed a leak in the cup of the second lift. We were first made aware of this by the holder unsealing when fully inflated—the gas escaping until the third lift touched the rest-blocks. The leak was located and marked on the sheet above. The holder was then lowered until the cup was fully uncupped from the dip. In this position the cup was filled with clay, well rammed for about 3 ft. on each side of, and including, the point of ascertained leakage. The holder was then raised until the cup just touched the dip, and a piece of timber measuring 6 in. by 2 in. by 3 ft. was pressed down into the clay to the bottom of the cup opposite the locating mark of leakage on the sheet. The timber was thereafter withdrawn, and the leak showed itself by water running into the cup from inside the tank. After the nature of the leak had been ascertained, the clay which had been parted by the timber was closed up again, so as to work the holder while the patch was being prepared. When the patch was ready, the holder was allowed to rise until the cup was about 2 ft. out of the tank. The clay was parted sufficiently to allow the patch to be placed over the hole, where it was held in position by a prop from the dip to the patch. Holes were then drilled in the cup plates through the patch, and T-headed bolts inserted. When all was secure, the clay was cleared away from the cup. The men on the job wore gas helmets. So far the repair has proved most efficient; and great credit is due to Messrs. Clayton, Son, & Co., Ltd., of Leeds, who had the work in hand. The only alternatives were to put the holder out of action—which we could ill-afford, as it represents half of our total storage—or to leave the third lift on the rest blocks, which would still reduce our storage by about 18 p.ct. To keep the cup sealed by constantly replacing the water was hardly practicable, as unsealing took place within three hours of the cup being full of water; and this would have meant constant watchfulness night and day.

While on the subject of gasholders, I take the opportunity of heartily supporting a recent suggestion of systematically collecting gasholder experiences, and such data as will enable the most efficient and economical means to be generally adopted in reference to repairs, corrosion, &c., of these costly structures. The subject is surely important enough to bring into being yet one more Committee—the Gasholder Committee—for at least an examination into the potentialities of united inquiry. In present circumstances, gasholders must be undergoing depreciation at a greater rate than ever before; and the need for laying accurate plans, that will both successfully and economically cope with the situation that is coming, does not call for amplification. Doubtless, erecting firms have a larger store of knowledge on the subject than any individual engineer can possibly have; but each firm has probably regarded its own knowledge as more or less sacred to its own archives. Pooling of knowledge, and combination for effecting economies in various directions, is very much to the fore to-day; and I can foresee a useful place for these forces in the sphere of gasholder economies.

IN CONCLUSION.

May the future have in store full recompense for the trials our industry has undergone in recent years—recompense befitting its indispensability to the best interests of the nation.

Mr. J. TERRACE (Grimsby) proposed a hearty vote of thanks to the President for his interesting address. The President had dealt with matters of real worth from his own experience in connection with work that he had recently carried out so successfully for his Company. The calibre of their President was very great; and they had listened with considerable pleasure to the details he had given them. They showed them the careful investigator and worker.

Mr. H. WIMHURST seconded the motion, which was carried by acclamation.

The PRESIDENT, in acknowledging the vote, said it had been quite a pleasure to him to write the address. His only disappointment was that the members could not visit Longwood on account of railway inconveniences; but if any members cared to call and see the new works, he would be glad to show them round, and give them all information possible.

AN INTERMITTENT TAR-DEHYDRATING PLANT.

Mr. H. R. WIMHURST (Bury St. Edmunds) then read a paper on this subject. It, with a report of the discussion will appear next week.

The PRESIDENT proposed, and Mr. TROUGHTON seconded, a vote of thanks to Mr. Wimhurst for his paper; and this was heartily accorded.

ELECTION OF OFFICERS.

The PRESIDENT proposed, as his successor in the presidency, Mr. H. R. Wimhurst, of Bury St. Edmund's. Mr. Wimhurst, he said, came of a family that had been connected with, and had been honoured by, the Association since it was founded. In his hands, the traditions of the family would no doubt be worthily maintained.

The motion was seconded by Mr. A. W. SUMNER (Grays), and unanimously adopted.

Mr. W. W. Townsend (Colchester) was elected Vice-President, on the proposal of Mr. H. R. WIMHURST, seconded by Mr. E. A. MALLETT (Ipswich). Reference was made to the circumstance that Mr. Townsend had recently undergone a delicate operation to the ear, and, on that account, might not be able to attend to affairs for a few weeks. A motion expressive of sympathy with him in his illness was adopted, on the suggestion of Mr. JOHN BARTON (Peterborough).

Mr. F. M. Paternoster (Felixstowe), to the value of whose services extending over seven or eight years testimony was borne, was re-elected Hon. Secretary and Treasurer, on the proposal of Mr. H. R. WIMHURST, seconded by Mr. E. F. KEABLE (Gorleston).

Mr. J. S. Dougall (Boston) and Mr. A. W. Sumner (Grays) were elected members of the Committee.

The retiring Auditors, Mr. W. Beale (Royston) and Mr. W. Brown (Brandon) were re-elected.

PLACE OF NEXT MEETING.

It was agreed to leave the fixing of the place of the next meeting in the hands of the Committee and of the new President.

Mr. TROUGHTON said he hoped the Committee would consider the claims of Bury St. Edmunds, which was absolutely the hub of the Eastern Counties.

REPRESENTATION ON NATIONAL GAS COUNCIL.

Mr. W. W. Townsend was elected to represent the Association on the National Gas Council.

VOTES OF THANKS.

Thanks to the President and officers for their services were accorded on the motion of Mr. H. WIMHURST, seconded by Mr. TROUGHTON.

An acknowledgment by Mr. BREARLEY brought the meeting to a close.

ILLINOIS STATE STANDARDS FOR GAS SERVICE.

At the meeting of the Illinois Gas Association, the Assistant Engineer of the State Utilities Commissioners, Mr. F. D. Fletcher, gave a lengthy account of the rules and regulations to which the gas industry was subject in the State. The aim was to ensure an efficient supply of good and reasonably uniform gas, distributed under satisfactory pressure conditions and accurately metered.

On several occasions some relaxatian had been granted to small concerns that would find difficulty in complying with regulations quite practicable in larger districts, as a laboratory and meter proving department were indispensable to adequate compliance with the conditions. Refunds on meters proved to be in excess of 2 p.ct. fast were to take effect over the whole time the meter had been in use—not exceeding six months; and while there was no reason why a consumer should not pay for unregistered gas due to defects beyond the control of the gas company, the difficulties and ill-feeling created by attempts to recover prevented the majority from attempting to do so. They preferred to minimize loss from this source by watchfulness and care of meters; and while there was no special rule as to the responsibility in this direction, five years' uninterrupted use, or fixing at more than 1 p.ct. slow in the first place, came under controllable conditions.

The importance of orderly systematic filing, tabulation, and periodical examination of meter tests and complaints was emphasized; also of periodical house-to-house meter tests. The competing daily use of the calorimeter was recommended. The Illinois standard of 565 B.Th.U. per cubic foot had been selected after careful inquiry as suitable and fair both to consumers and suppliers, on the basis of maximum British thermal units per dollar charged; and this would vary under different local conditions in other States. Under present-day conditions, the total heating value of a gas was the fairest test of usefulness, and also was practically the basis on which other fuels were rated. The average heating value per month, together with a suitable minimum, was used as a basis for the official report, and an allowance of 35 B.Th.U. was made on the monthly average to cover high-pressure and long-distance distribution. The purity restrictions included a maximum of 30 grains per 100 c.ft. for total sulphur—purposely fixed high to admit the use of local sulphurous coals; but companies making carburetted water gas were able to keep below 10 grains. Daily tests for sulphuretted hydrogen should be the rule; and the limit was 1 grain per 100 c.ft. A fixed pressure at any one point was not always necessary. It was more important that the variation should not be too wide; and therefore in place of one quantity, the maximum, minimum, and allowable variation were specified. Increase of consumption and difficulties of carrying out main pipe enlargements or extensions caused a tendency towards higher distribution pressures, which might be carried too far.

Ordinary meters and appliances were not suited for more than 8 in. Every additional 4 in. meant 1 p.ct. decrease in bulk at the meter; and, in the absence of competent re-adjustment, high pressure was a cause of waste at burners. Consumers had a right to expect pressure sufficient to operate appliances satisfactorily with reasonable house piping; and a minimum of 20-10ths would ensure this result. Uniformity of pressure was essential; and a reasonable allowance for variation was within 100 p.ct. of the maximum, limited to the basis of any one day. Very little use was made of portable recording pressure gauges, which were indispensable to a correct survey of the true pressure conditions. A sufficient number of charts should be taken each month to indicate clearly the conditions prevalent in all parts of the distribution system.

PURCHASE AND USE OF GAS OILS.

Mr. F. L. Weisser, the Superintendent of the Gas Department of the San Antonio Gas and Electric Company (Texas), remarks in the New York "Gas Age" that the purchase of gas oils is now more a matter of delivery conditions than of selection to suit requirements; and with variation of quality, it is desirable to determine the most efficient working conditions by laboratory tests. He proceeds to outline methods of arriving at the total heating power, and the percentage actually transmitted from the oil to the finished gas.

The ratio between the two indicates practical efficiency, which is affected by many conditions—such as time of contact, production of tar, naphthalene, and carbon, working temperatures, &c. It is necessary to feel the way by several tests under varying conditions. A steel tube 2 in. diameter and 40 in. long is covered with fire-clay 1½ in. thick, and set in a fire-brick lined gas-furnace. The burner consists of a ¾-in. blast tube extending the full length, perforated with two rows of $\frac{3}{32}$-in. holes ½ in. apart. Oil to be tested and blue gas are admitted through a ¼-in. pipe tapped into the cap on the upper end of the 2-in. tube; and the finished gas escapes through a 1-in. pipe secured to the lower end. Blue gas from the water-gas plant may be used, but must be stored in a test holder to admit of analysis; and the quantity taken for the test is measured through a test meter at the outlet. The oil is fed from a graduated burette; and a pressure-equalizing tube connects the gas and oil inlet with the top of the burette, forming a closed circuit. The gas passes from the lower end of the 2-in. tube through a seal, condenser, cotton and bead packed scrubbers, and meter, to a test holder. Constant and uniform heating must be maintained throughout the experiment, and be checked frequently by the use of a high-temperature pyrometer; and the temperature of the inlet and outlet gas and oil must also be taken by accurate thermometers. The indications should be read at two-minute intervals. The following is an example of the data and results thus obtained, on a twenty-minute test.

Gas Oil.—Temperature, 108°. Sp. gr. at 60°, ·821; at 108°, ·804. B.Th.U. per lb., 19,251. 48·5 c.c. used.
Temperatures.—Furnace, 1500° Fahr. Gas inlet, 84°; outlet, 84°.
Barometer.—29·3 in. Correction to 30 in., 0·912.
Calorific Value.—Finished gas, 636 B.Th.U.; calculated ditto of blue gas, 293 B.Th.U.
Blue Gas Used.—2·021 c.ft. Finished gas, 2·796 c.ft.; oil gas, 0·775 c.ft. Finished gas = 72·3 p.ct. blue and 27·7 p.ct. oil gas.
Oil Used.—0·00457 gallon. Weight per short gallon (8⅛ lbs.) 6·71 lbs. B.Th.U. transmitted from oil to gas, 13,890

$$\text{B.Th.U. Practical efficiency} = \frac{13{,}890}{19{,}251} = 72{\cdot}1 \text{ p.ct.}$$

The economical use of gas oil, by avoiding an important excess of prescribed average in the quality of the manufactured gas, is insisted on by Mr. A. C. Howard, Gas Engineer to the New York United Gas and Electric Engineering Corporation, in a communication to the "American Gas Engineering Journal." The cost of oil has increased threefold within four years; and each B.Th.U. in excess of the standard is now equivalent to about £7, for cost of oil only, per million c.ft. of gas manufactured. Daily tests on the calorimeter are not sufficient. They should be taken hourly, and the oil supply to the carburettor arranged accordingly.

When mixed gas is sent out, arrangements should be made to ensure uniform quality over the whole 24 hours. Consumers' appliances, properly adjusted to suit a half-and-half mixture, will be liable to strike-back if supplied with anything approaching straight water gas, or to produce soot and clog mantles on nearly pure coal gas. Sometimes considerations of convenience or economy lead to the intermittent use of the water-gas set (say, during the day only); and none may be admitted to the distribution holders for hours at a time. At times it was practicable to equalize delivery by the use of a storage holder of capacity equal to the period that the water-gas set was shut-down. Without uniform quality, it was not possible to work closely to the standard; and it was much easier to do so where one type of gas only was made. A 600 B.Th.U. carburetted gas required twice as much air for complete combustion as a 300 B.Th.U.; and a low but uniform quality might constitute better service to the consumers than a richer but more uneven gas.

Early Benzol Investigations.

In the course of a paper which he presented at the annual convention of the Wisconsin Gas Association, Mr. F. E. Dodge said the benzols were first accurately determined to exist in the light distillate from coal tar in 1845, by A. W. Hofmann, who pointed out that the methods employed for the rectification of alcohol could be successfully used for their separation. From about this date to 1887, when F. Brunck applied the process proposed by Carves and worked out the details of a commercial plant, practically all these compounds were obtained from oils like Pintsch hydrocarbon, holder oil, gas drips, and water-gas tar. Nearly as early as Hofmann's work, experiments conducted by the Paris Gas Company showed that the benzols were nearly all contained in the gas. Berthelot in 1876, Bunsen in 1877, Knublauch in 1880, Dennstedt and Ahrens in 1894, and Bunte the same year, confirmed this. Various methods, such as compression and cooling to a low temperature, were proposed to separate these compounds from the gas. In 1859 Vogel passed coal gas through colza oil, which, he said, took up 20·5 p.ct. of its weight of light oil, and increased very much in illuminating power, without materially affecting the quality of the gas. This last is, the author remarks, absurd, as the removal of these compounds reduces the B.Th.U. 5 to 6 p.ct., and the candle power as much or more. Vogel did not aim to remove the benzols, but to improve the quality of colza oil for illuminating purposes. Caro, Clemm, and Engelhorn in 1869 used practically the same process as is now employed; but the fall in the price of benzol and toluol, and the low value of the stripped gas, soon made it unprofitable. The advent of bye-product coke-ovens led Franz Brunk at Kaiserstuhl to employ the Carves apparatus, in which heavy oil from the distillation of coal tar was used. A continuous still was substituted to debenzolize the wash-oil about 1894.

Ammonia and Ammonia Products.—All purchasers of sulphate of ammonia for any purpose other than for use as a fertilizer, and all purchasers of anhydrous ammonia, liquid ammonia, salts, or other preparations containing ammonia (except crude gas liquor), in monthly amounts greater than for anhydrous ammonia 56 lbs. per month and for salts or other preparations containing ammonia 112 lbs. per month, are recommended to register their names with the Director of Acid Supplies, Department of Explosives Supply, Storey's Gate, Westminster, S.W. 1—forwarding at the same time particulars of their consumption of each product referred to for the year 1917, and indicating the exact purpose for which the ammonia product is required.

STRESSES IN GASHOLDERS.

By Frank H. Robinson, Assoc. M.Inst.C.E.

[A Paper read before the North of England Gas Managers' Association, Saturday, May 4.]

The gasholder is one of the most important and conspicuous parts of a gas-works; but it is the one part which of late years has received the least attention at meetings of gas engineers. It may be that it seldom falls to the lot of a gas engineer to design a new holder. In many cases, when a new holder is required, the official concerned does not himself design the structure, but invites competitive designs from contractors. There is also the fact that when once put into action, it gives a negligible amount of trouble, and so very little thought is expended upon it.

The design of a gasholder is full of most interesting problems to an engineer; and unless these problems are all tackled in a scientific manner, backed up by a good knowledge of applied mechanics and kindred subjects, the design can very well be wasteful in one direction and weak in another. The problems involved are so very different from those that are involved in a roof or a bridge, which can be solved either mathematically or graphically. There we have a rigid structure, but here we have one part rigid and the other floating; and thus the stresses are varying hour by hour.

In order not to make this paper unduly long, the author will confine himself chiefly to the holder itself, and very little will be said about the guide-framing. Mr. F. S. Cripps has dealt very fully with this subject in his book on the "Guide Framing of Gasholders" [which is, unfortunately, out of print]. When we come to the holder itself, there is little information beyond the stresses in the top curb and the crown sheets. Mr. Cripps gives the following formula for the stresses in the top curb:

$$X = \frac{(a^2 + b^2)p\mathrm{D}}{8b} + 6{\cdot}5\,\mathrm{D}d - \frac{p_1\mathrm{D}d}{c}$$

Where X = compression on one side of the curb (in pounds) where there is no trussing.
a = half diameter of top lift in feet.
b = rise of crown in feet.
p = effective pressure of gas in pounds per square foot.
p = actual pressure of gas in pounds per square foot.
D = diameter of top lift in feet.
d = depth of top lift in feet.
c = 10 for vertical stays fast to the side sheets all the way up.
C = 16 for do., loose.

Now this formula, being empirical, does not convey to the engineer any idea of the direction or magnitude of the forces which come into play on the curb; and the object of this paper is to show, step by step, the principles underlying such a formula, and to indicate the methods of calculating the forces in other parts of the structure, and how these forces are met in the design.

An inflated gasholder with valves closed is in equilibrium. Every force in the structure must therefore be counterbalanced by one or more forces in other directions to preserve this equilibrium; otherwise the structure will collapse. The forces acting on the gasholder bell are two, three, or four in number, according to circumstances. The two which are always present are the downward weight of the bell and the pressure of the gas from the inside due to this weight. The other forces which act on the holder are wind and snow. These may be acting singly or else together, in conjunction with the two first-mentioned forces. These various forces produce stresses in the various parts of the structure according to their intensity; and these stresses may be tensional, compressional, or even compound.

Stresses in Crown Sheets.

The stress in the crown plates of a holder is one of tension, and is directly proportional to the radius of the curve of the crown, or in inverse proportion to the rise. In other words, the flatter the crown, the greater the tension in the sheets. The crown is a segment of a sphere, and therefore the stress is uniform throughout. The usual rise is 5 p.ct. of the diameter; but as this is not exactly followed in every case, it is useless to base any formula upon it. The radius of the sphere should, therefore, be taken. This is obtained from the following formula (which can easily be proved by the application of a well-known proposition of Euclid):

$$\text{Radius} = \frac{a^2 + b^2}{2b}$$

Where a = half diameter of crown,
b = rise of crown.

A holder crown having a rise of 5 ft. and 100 ft. diameter has a radius of 252·5 ft.

If r is the radius of the curve of the crown and p is the effective pressure of the gas underneath it in pounds per square foot, then the total pressure in pounds tending to burst a sphere of a diameter $2r$ is $p \times$ cross area of the sphere at its centre.

$$\text{Total pressure} = p \times \frac{\pi}{4} d^2$$
$$\text{" " } = p \times \pi r^2$$
$$\text{" " } = \pi p r^2$$

The stress per lineal foot on the material forming the hollow sphere is therefore:

Total pressure in pounds ÷ circumference in feet;

$$i.e., \pi p r^2 \div 2\pi r$$
$$= \frac{\pi p r^2}{2\pi r}$$
$$= \frac{p r}{2}$$

If the stress is required in terms of the rise and diameter of the crown, we get—

$$\text{Stress per lineal feet in pounds} = \frac{p r}{2}$$
$$\text{" " " " } = \frac{p (a^2 + b^2)}{4b}$$

As stated previously, this stress is uniform throughout the sphere, and should therefore be true for a segment of a sphere such as a gasholder crown.

Assuming a pressure of 4 in. of water in a gasholder 100 ft. diameter with a rise of 5 ft. in the crown, then the stress works out at 1·18 tons (2630 lbs.) per lineal foot at any part of its surface. To withstand this, sheets $\frac{1}{10}$th in. thick would be sufficient after allowing for the rivets. But this would, of course, be quite insufficient to resist corrosion or to support the weight of a man. Sheets are made about four times this thickness.

With the holder telescoped, we get a proportionately increased stress. Although the stress is theoretically uniform throughout the crown, the centre crown plate is always made thicker than the adjoining sheets. This is necessary with a trussed crown on account of its connection with the centre post, but is not so necessary in the case of an untrussed crown. The outer row of crown sheets is also made of thicker material (1) to take up part of the curb stress, (2) that it is better to join the thin sheets to the thicker angle at the curb through the medium of a sheet of moderate thickness, (3) to counteract a tendency to buckle. A layer of snow only increases the tension on the sheets through causing increased pressure inside the holder.

The author would impress upon his audience the method of arriving at the tension in the crown sheets, as the formula given above is the principal factor in causing compression in the top curb and forms the basis of the first item of Mr. Cripps' formula. The *pros* and *cons* of trussing the holder will be dealt with later.

Stresses in Side Sheets.

The side sheets are subjected to slight tension due to gas pressure, the amount of which can be calculated in the same manner as a cylindrical boiler shell. It should, however, be noted that when the outside wind pressure per square foot exceeds the internal gas pressure, the sheets are in compression; but this rarely happens, and is then only so slight that it can be ignored.

The hanging weight of the bottom curb and the other lifts is taken up by the vertical stays, which should be fastened all the way up. These stays should be stiff enough to safely resist both a tension stress and a bending action—the latter due to the pressure of gas within the holder; also, in the case of a telescopic holder, extra strength must be allowed for to meet the thrust of the inside bottom rollers of the inner lifts.

Fig. 1 shows, in diagram, the forces on the stays:

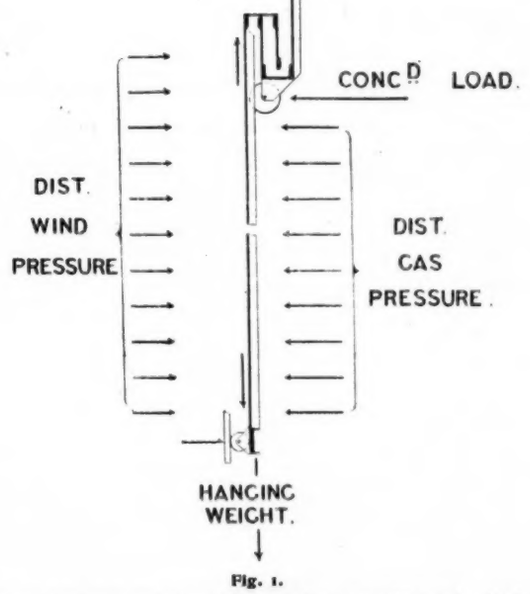


Fig. 1.

If the holder is spiral-guided, considerable stiffness is obtained in the spiral rails running round each lift.

Stresses in the Top Curb.

We now come to the most important part of the structure. If the tension per lineal foot of the crown sheets by the formula given previously—

$$\frac{p\,(a^2+b^2)}{4b}$$

is taken and multiplied by the diameter D, we get,

$$\frac{p\,D\,(a^2+b^2)}{4b}$$

as the total tension across the diameter which must be resisted by forces in the opposite direction—that is, by resistance or compression in the curb.

Dividing the above formula by 2 to obtain the compression in one part of the curb, due to tension in the crown sheets, we get:

$$\frac{p\,D\,(a^2+b^2)}{8b}$$

which is exactly the first and chief item in Mr. Cripps's formula.

The second item of the formula ($6{\cdot}5\,D\,d$) is the allowance for wind pressure. The wind pressure on half the top lift is $D \times \frac{1}{2}d. \times 52$ lbs., or $26\,D\,d$. The effective pressure due to the circular form of the structure is only half this figure, or $13\,D\,d$. This is the pressure taken up by the two sides of the curb. For one side, therefore, the compression on the curb is half $13\,D\,d$, or $6{\cdot}5\,D\,d$. This is partly neutralized by the gas pressure inside the holder. Hence the subtraction of the third item.

As already stated, the curb is in compression chiefly; but later it will be shown that there is a compound stress tending to buckle up the plates near the curb. If the curb, with its adjacent crown and side sheets, is drawn in diagram with all the forces plotted to scale, it is possible to find the resultant graphically, which can be checked by using Mr. Cripps's formula. Fig. 2 shows the forces acting on the windward side:

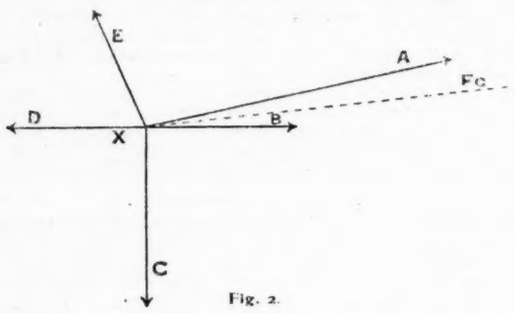


Fig. 2.

The point X is taken as the curb, and the forces acting on it are: A, tension in crown sheets; B, external wind pressure; C, downward weight of side sheets, &c.; D, internal gas pressure on side sheets; E, upward gas pressure on crown sheets. The resultant of all these forces is Fc—its magnitude and direction unknown.

Take a unit length of 1 ft. of the curb.

Force A is found from formula $\frac{(a^2+b^2)\,p}{4\,b}$

Force B is found by taking half the depth of the lift $\left(\frac{d}{2}\right)$ and multiplying by 56 lbs. per square as the maximum wind pressure, or 28 lbs. effective on a round surface.

Force C is the total weight of the holder divided by the circumference. The weight of the holder is obtained by taking the pressure of gas per square foot and multiplying by the area of the crown.

Force D is obtained in the same manner as Force B, substituting gas pressure for wind pressure.

Force E is obtained (1) by taking the area of a triangle whose base is 1 ft. long, with height equal to half the diameter of the crown, and multiplying this by the gas pressure per square foot in pounds; (2) two-thirds of this figure is the force E.

With a holder 100 ft. diameter and 20 ft. deep on the inner lift, giving a pressure of 7 in. of water, we get the magnitude of the forces as follows: A, 4602 lbs.; B, 280 lbs.; C, 912 lbs.; D, 365 lbs.; E, 912 lbs. Plotting these out, we get the following (fig. 3) when resolved by two forces at a time:

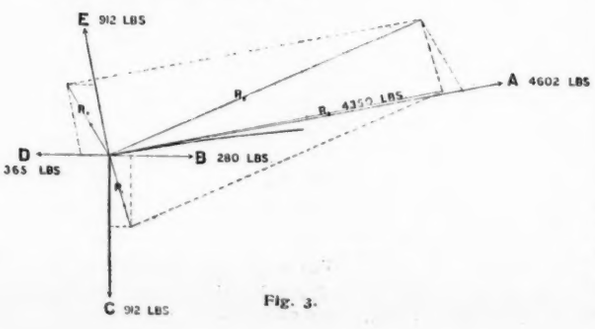


Fig. 3.

The resultant is found along Fc, and (on scaling) is 4340 lbs., which, when resolved horizontally, gives 4250 lbs. for the unit length of curb of 1 ft. Multiplying this by the diameter of the holder in feet, we get the compression across the diameter, which, divided by 2, gives 217,500 lbs. (97 tons) as the compression stress at any point in the curb.

Using Mr. Cripps's formula, the stress obtained is 236,250 lbs. (105·5 tons) at any point in the curb. The formula of Mr. Cripps makes no allowance for the upward pressure of the gas under the crown sheets and the downward pull of the holder side sheets. This is easily explained on reference to fig. 3; for it will be seen that the forces C and E are equal in intensity and in almost opposite directions; and they therefore practically neutralize each other. In these circumstances, it is not necessary to bring them into the calculation. The difference between the compression obtained by calculation and graphics may be explained for the most part by the different values taken for wind pressure and by the formula making no correction for the inclination of the crown sheets at the curb. The result obtained graphically is, however, sufficiently close to show that, for practical purposes, the formula given is a safe one.

It should be noted that, when there is no wind pressure, the tension on the crown sheets is the same as in a wind, but the compression on the curb is reduced.

In the above calculations, snow has been ignored. It is hardly to be expected that snow will remain on the windward side of the crown in a high wind; and the weight of snow on the leeward side will only tend to keep the holder tight up against its guides on that side in the case of a guide-framed holder, and throwing extra pressure on to the guides and rollers in the case of a spiral-guided holder. Fig. 4 will show what is meant.

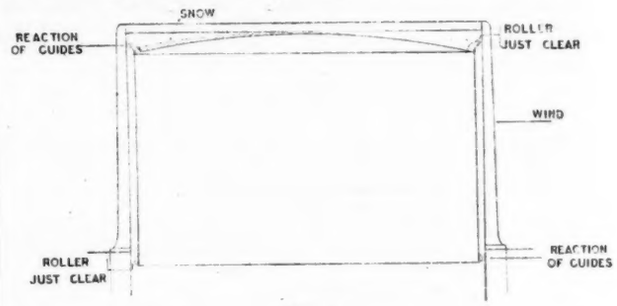


Fig. 4.

To meet this, the carriage must be designed with due regard to stiffness, and particular attention paid to the fastenings to the holder crown. When no wind is blowing and snow covers the whole crown, an increase of pressure is produced which is sufficient to support the extra load on the crown. When it is remembered that every force must have its resultant or reactionary force, many such points raised in the paper will be clear.

Stresses in the Bottom Curb.

The stress in the bottom curb is tensional or compressional, according to whether the gas pressure inside the holder is greater or less than that of the outside wind pressure.

Thus: Total stress in curb = total wind pressure − total gas pressure.

$$2\,C = \frac{P^W D d}{2} - \frac{P^G D d}{2}$$

$$,, = \frac{D d}{2}\left(P^W - P^G\right) \text{ or } \frac{D d}{4}\left(P^W - P^G\right) \text{ for one side.}$$

With a wind pressure of 56 lbs. per square foot normal, and allowing for the circular shape of the structure (gas pressure being taken at 4 in. for the single lift), we get a compression stress of 1·6 tons (P^W is 56 lbs. ÷ 2 = 28 lbs. effective pressure).

If the holder is telescoped, then the pressure on half the lower lift must be taken into account in addition to the above—practically doubling the stress. If there is no wind pressure, then the stress becomes one of tension; being 4·8 tons for the single lift and 9·6 tons for a telescoped holder. The bottom curbs and the cup and grip, as usually designed, provide ample margin of material to meet all stresses to which they may be subjected. The only point to bear in mind is that the rest-blocks should be of sufficient size and number to carry the whole suspended weight of the lower lifts without any danger of splitting or cutting by the sharp edge of the grip.

In connection with wind pressures, the full value of 56 lbs. per square foot normal has been taken, although it is a known fact that over a large structure like a gasholder there is not uniform wind pressure. Also the intensity of pressure varies according to the height of the surface from the ground, as found by the late Sir Benjamin Baker on the Forth Bridge, and, more recently, at the Godlee Observatory, near Marple, Cheshire. There is also a further point, that when a strong wind blows against an isolated object, such as a gasholder, a reactionary pressure is produced on the leeward side, such as one sees when a motor-car travelling at high speed raises the dust behind it and throws it on the occupants of the rear seat.

When we come to a spiral-guided gasholder, the stresses in the

crown sheets and top curb can be found as mentioned above; but it must be treated as a huge vertical cantilever supported at the top of the tank. The guide-rollers fixed to the tank must be designed to take compression, tension, or even compound stresses, with an allowance for shock caused by gusts of wind. As the curb is in compression and the top sheets are in tension, there is a compound stress in the outer row of crown sheets (fig. 5).

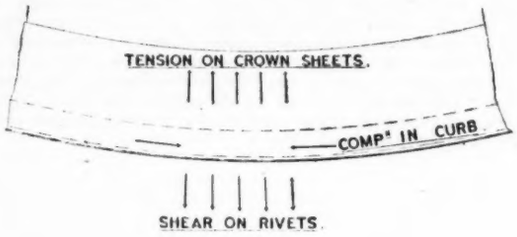


Fig. 5.

The effect of such a compound stress on the thin sheets forming the crown would be to buckle the crown up. Hence the need of having a thicker plate here. A practical illustration of this can be seen in the gas-bags used on motors. Those with flat ends, when fully inflated and tight, will show wrinkles all round the circumference of the flat end. All vessels subjected to internal pressure tend to become spherical; and if a holder is to preserve its shape, the top curb must be made stiff. This should not, however, be an excuse for making this part of the holder excessively strong. All stresses in the holder should be carefully worked out, and the structure designed accordingly. Rule-of-thumb methods should not be allowed; otherwise waste will be found in one direction and insufficient material in another. If an engineer requiring a new holder is unable to work out for himself the various stresses, then he should put the work into the hands of one who can do so, and not cover himself by putting metal into it. Even if able to do so, in an important structure like a gasholder, a second opinion from an experienced engineer is useful.

Turning to the support for the crown sheets when the holder is empty, we find that, for holders up to about 120 ft. diameter, the framing is attached to the holder, but above this size is built in the tank. The reason for this difference has never been clear to the author. If a large holder of 200 ft. or more in diameter can do quite well with a simple tank framing, why should a smaller one require roof trussing of an expensive design, such as one often meets? Again, this roof trussing is designed on the lines of a roof for a building with round or flat tie-bars and angle or tee bars as rafters. The only consideration has evidently been the holder empty. Here there is a contradictory design—the top curb in compression when the holder is full and the tie-bars of the trussing designed only to meet tension. If the engineer prefers to retain a trussed crown, then all the members should be designed to meet compression where the stress alternates between this and tension, and the stiffening effect of a trussed crown on the top curb be taken into account, so economizing in material. The author has seen a holder of 100 ft. diameter, and also a lesser one, where almost every tie-rod of the trussing was bent. It should be stated that this 100 ft. holder was built over fifty years ago, and possibly rule-of-thumb methods applied in design.

It may be said by those to whom practice makes a strong appeal, that all this theory is of very little use, and it is practice that counts. To them, the answer is that practice without theory is the cause of much waste and faulty design, and often disaster. At the same time, theory without practice would result in some weird structures and some bad language on the part of erectors. To the author's mind, the theory should form the foundation of design upon which a superstructure of practical knowledge is built if the best results are to be obtained. The author knew personally a case where a draughtsman (who had been trained as an architect) designed a roof with large circular principals, each resting on a single joist stanchion, 30 ft. long and only 7 in. wide, with very little lateral support. The design looked absolutely right on the transverse section, so far as proportion was concerned; but a knowledge of the theory of structures would have shown this gentleman that his stanchion had a factor of safety less than 3—and this in a situation where steel would corrode very rapidly. These stanchions had eventually to be cased some 12 ft. up in concrete to stiffen them and resist corrosion. This was a case of practice without theory.

In conclusion, the author would appeal for more artistic treatment of such structures as gasholders. By this it is not suggested that rosettes, elaborate finials, &c., should be fixed anywhere and everywhere, but that proportion and general elegance should receive due consideration from the designer. A neighbouring engineer obtained the proportions of his new holder from an old cabinet. Finding something about this cabinet which appealed to his eye as artistic, he saw it in its proportions, and applied his acquired knowledge to the design of his holder. Who will say that this was wrong? Mere utility should not be the only consideration. Ugly gas-works are far too common; and Ruskin's "Seven Lamps of Architecture" might be profitably read by many an engineer.

DISCUSSION.

Mr. A. C. HOVEY (Sheffield) said Mr. Robinson's paper was largely in the nature of an exposition and explanation of Mr. Cripps's formula relating to gasholder stresses; and he thought the Association was indebted to the author for the explanations he had given. Looking at the formula published by Mr. Cripps, it appeared elaborate and complicated; but after the explanations given by Mr. Robinson "he who runs may read." In the formula given by Mr. Cripps, and with regard to the book which had been referred to—Mr. Cripps had written other books—it was recognized that they contained the best particulars available in reference to the design and the stresses which occur in gasholders and their framing. In the formulæ referred to, it was shown how much effect resulted from securing internal guides throughout their length. Regarding stresses in the crown sheets, Mr. Robinson said the usual rise was 5 p.ct. of the diameter; but he (Mr. Hovey) suggested that perhaps 7½ p.ct. might be a better figure to work to. Water might lodge (especially towards the centre of the crown), and cause deterioration of the plates. Snow was referred to as being distributed evenly over the crown; but what if it lay to one side? The only effect would then be to press the rollers against the framing. If all the rollers were properly adjusted, this might be largely the case. But there were possibilities of severe tilting action; and disasters had been known through snow being on one side. Mr. Robinson did not refer to the strength given to a gasholder by the cups, the grips, and the different lifts. The top curb had an important function, which was to distribute the stresses from the wind over the different portions of the guide-framing. There should be no skimping of this portion of the holder. The wind pressure of 56 lbs. was high, but was on the right side. He (Mr. Hovey) would not like to rely on the theory of there being reactionary pressure on the leeward side of the holder when there was a strong wind blowing. Reference was made to gusts and shock. Certainly these were very important things; and if they had a low margin allowed for wind-pressure, these had not been taken into consideration. If there was no play there was likely to be very severe stresses thrown on the holders; and these might give at one point, instead of being generally distributed.

Mr. C. DRU DRURY (Sunderland) complimented Mr. Robinson upon his paper, which was, he said, a welcome change to most of the subjects which had been discussed by the Association. One debateable part of the paper seemed to be near the end of it, where reference was made to trussed and untrussed crowns. He thought that for small holders, up to 150 ft. dia., it was better to have trussed rather than untrussed crowns. They wanted weight on the top lift, and they might as well put the weight into the trussing. The only other debateable point was in respect of the artistic treatment of gasholders. He personally had always been in favour of making gas-works as presentable as possible—avoiding at the same time all excess of ornamentation. For a little outlay, it might be possible to make gas-works pleasing to look at. While saying this, he defied anyone to make a spiral gasholder look artistic, except by having resort to methods of camouflage. He did not think residents near gasholders looked upon them as artistic structures. There were, however, many types of framing which were more or less artistic. He considered the external-framed holder had points in its favour over the spiral holder.

Mr. ROBINSON, in reply to the discussion, said it had been regarded as an assumption that the reaction of the wind caused a vacuum on the leeward side; but he reminded the meeting that test had actually been made to show that there was reactionary pressure on the leeward side. It might be thought that his paper was theoretical; but his whole point was that before they could design any structure (if they were going to design an economic structure), they must know the theory of it. He did not think that theory was the whole thing—it was not the alpha and omega of design; but they must start with theory, and then apply their practice to it. With regard to the trussing of small holders, he still adhered to the view that it was unnecessary, and that instead of putting weight on the top lift it would be much better if the weight was put in the sheets. Respecting the paper in general, he (Mr. Robinson) said it was written two years ago; but he afterwards found that his original ideas were wrong because he had ignored the question of any hollow body tending to become spherical under internal pressure. This had been to him a most interesting study.

Gas for Tempering Saws.

Some details of the advantages of tempering saws by the aid of gas have been given by Mr. E. J. Caspers in the "Public Service Lumen" of America. Crucible steel is used for high-grade saws, and open-hearth steel for cross-cut and hand saws; and though saws of various sizes for different purposes require some modification of the several stages of manufacture, generally speaking the journey of a saw from its beginning as an ingot to the finishing-point is much the same. The tempering of the saw is really the vital operation. For this wood and coke have served as fuel, as well as oil; while of late years electricity has also had a part. The use of gas for the purpose is comparatively recent. However, the Engineers of the Public Service Company of Northern Illinois designed for a certain saw company (who formerly used crude oil as fuel) a hardening furnace to be run on gas, which in practice has proved completely successful, having eliminated all the trouble that was experienced with oil. The hearth is 10 ft. by 6 ft. by 3ft.; and the flame is directed under the hearth, thus eliminating the moving of the saws. No trouble is experienced in maintaining the oven at the desired temperature, which is nearly 1700° Fahr.; and the furnace will take a 60 in. diameter saw.

The President of the Institution of Civil Engineers for the year 1918-19 is Sir John A. F. Aspinall; while the members of Council include Mr. Charles Carpenter, D.Sc., Sir Dugald Clerk, Sir Robert A. Hadfield, Bart., and Captain H. Riall Sankey.

REINFORCEMENT OF DISTRICT SUPPLIES.

By Walter Hole.

[A Paper read before the North of England Gas Managers' Association, Saturday, May 4.]

The enormous expansion of our large towns provides the distributing engineer with some of his most interesting problems. Of recent years, in addition to the migration of population, there has come the development of light railways, and of motor and other transport facilities, which have among other things made possible the change of location of large industrial establishments. On the one hand there has therefore been a tendency to move many of these from the centre to the outskirts of large urban areas; and, on the other, new factories and workshops of considerable size have almost invariably been set up in the out-districts. And this movement of the industrial centre of gravity has been accompanied by a very great development in the uses of gas for industrial purposes. The consequence has been that frequently the demand for large quantities of gas has arisen precisely in those outskirt areas where the distributing system has been least able to respond to it. There can be little doubt, too, that the movement referred to is far more likely in the future to increase than to diminish, and the methods by which such demands have been met in any one centre, therefore, become of far more than local interest. It is this consideration which has emboldened the author to put before the Association the following brief sketch of some recent extensions which have been carried out by the department with which he is connected.

West Leeds District.

On its west side, the City of Leeds stretches out to and embraces the Hamlet of Rodley. This is about six miles distant from the centre of the city. Along the line running out westward there are the New Wortley Gas-Works about 2000 yards from the centre of the city, and the Kirkstall Road gasholder station, 2000 yards further on. From the latter to Rodley is about 6800 yards, and in between is the district of Kirkstall, which lies roughly 4700 yards from New Wortley and 2600 yards from the Kirkstall gasholder station. New Wortley, the Kirkstall Road station, Kirkstall, and Rodley lie practically at the level of the River Aire, the course of which (neglecting several prominent loops) is through this section from west to east. From Kirkstall Bridge and Rodley the ground rises rapidly on the north and south from the valley, giving a difference of altitude of from 200 to 250 ft.

How Supplied.

Kirkstall is supplied with gas through two 14-in. mains (one on each side of the roadway) fed from the New Wortley works, with a backing from the Kirkstall gasholder station. Rodley was originally supplied from Kirkstall Bridge through an 8-in. main laid successively alongside the Midland Railway track and the Leeds and Liverpool Canal. Subsequently a 10-in. main was laid from the Kirkstall Road station, by the road route, which supplied, at gasholder pressure, a station governor at Rodley. This then became the chief means of supply for the district. The growth of the industrial and domestic demand for gas during the last decade both at Kirkstall and Rodley has been so great that the distributing system had become quite overworked.

New Demands.

This was the general position when in 1915 the department was confronted by a demand for a supply of 10,000 c.ft. per hour for a large new industrial establishment. The existing plant was unable to cope with such an increase. It was necessary, therefore, to review the position as a whole, in order to determine the best solution of the problem of how to meet the existing necessity for an augmented supply of gas to both the Kirkstall and Rodley districts, and the provision of an altogether new supply to the Newlay establishment. The additional maximum quantity of gas needed was estimated as follows:

Kirkstall	25,000 c.ft. per hour
Newlay	10,000 ,, ,,
Rodley	15,000 ,, ,,
Total	50,000 c.ft. per hour

It was, therefore, decided to extend the existing governor house at Kirkstall Road, put down a compressing plant, convert the 10-in independent into a high-pressure main, take off a boosting feed into the 12-in. distributing main near Kirkstall Bridge, boost-up the existing supply to Rodley, and at the same time provide for the new supply wanted. It is the purpose of this paper to describe how these plans were carried out.

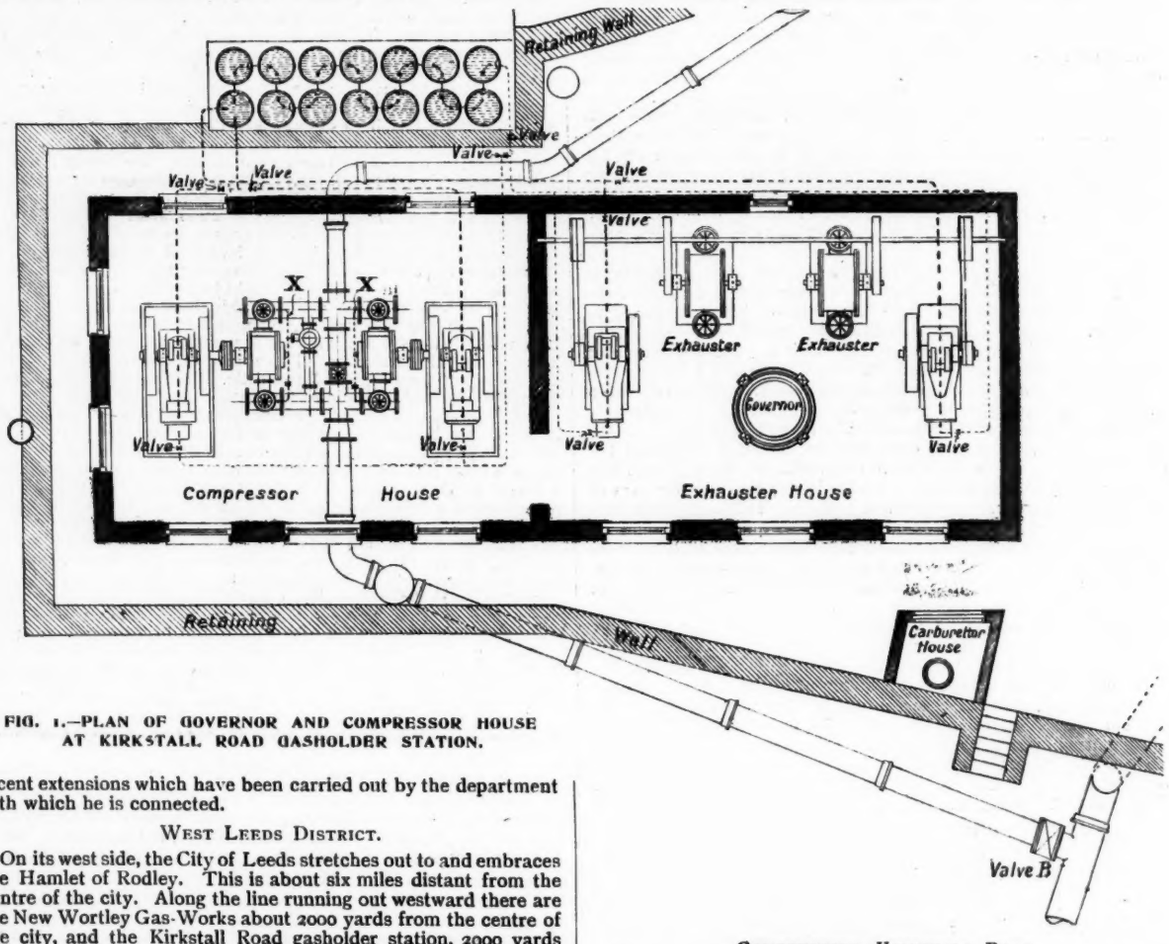


FIG. 1.—PLAN OF GOVERNOR AND COMPRESSOR HOUSE AT KIRKSTALL ROAD GASHOLDER STATION.

Compressors, Kirkstall Road.

Fig. 1 shows the plan of the compressor and governor house that was erected at the Kirkstall Road gasholder station, and fig. 2 is a photograph of the interior of the compressor house. The compressing plant consists of a duplicate set of the Bryan Donkin Company's two-bladed rotary compressors, each of them capable of raising 80,000 c.ft. of gas per hour, at 170 revs. per minute, from an initial minimum pressure of 6 inches head of water to 70 inches head of water. Both compressors are fitted with inlet and outlet valves of the screw-down disc pattern; and a 3-in. bye-pass has been arranged between the inlet and outlet valves, to facilitate the starting-up of the gas-engines. Forced lubrication—consisting of a gun-metal single-ram oil-pump—is provided on each compressor for feeding the pin. The other lubricators on the compressors are of the "Clean-Easy" type. A 6-in. excess pressure valve is fixed between the inlet and outlet mains of the compressors. This valve is so arranged that any increase of outlet pressure causes the valve to open and bye-pass some of the gas back to the inlet, thereby maintaining a constant

pressure on the outlet. The valve may be adjusted by weights to give any desired outlet pressure. The compressors are direct coupled by flexible couplings of the strap type to two gas-engines of (approximately) 40 B.H.P. The compressors are supplied by an 18-in. main brought direct from the outlet of the gasholders; and a 12-in. connection between the inlet and outlet mains, controlled by a 12-in. worm-and-rack valve, allows of the compressors being by-passed whenever necessary.

WATER CIRCULATION.

These engines were expected to be working something like twenty hours per day all the year round. The question of water economy was, therefore, important. With a view to saving under this head as much as possible, the tanks connected with the water circulation of the two new engines, together with those belonging to the two existing engines of similar size in the governor house —making a battery of sixteen tanks in all, each measuring 5 ft. 10 in. by 2 ft. 7 in.—were taken outside the house and fixed upon a concrete foundation, well above the gas-engine level, as shown in sectional elevation in fig. 1. The tanks were connected in consecutive series (as shown by the arrows), so that whatever engine or engines were running, the water circulated through the whole of the sixteen tanks. The result has been that the only fresh water used is that necessary to make good the loss by evaporation—the tanks themselves being fully sufficient to keep the return water quite cool.

STATION GOVERNOR CHATTERING.

One curious and unexpected result of the starting-up of the installation was a certain interference with the working of the 24-in. station governor fixed in the adjoining room. This took the form of a continuous chattering, due to the propagation of impulses from the compressors back along the inlet pipe to the governor. This rattling was most pronounced when the governor was only slightly open and a comparatively small quantity of gas was passing through. When from half-way to full open it was hardly noticeable at all. Various expedients were tried to mitigate the evil; the ultimate cure being found in the simple plan of arranging a slight pull on the gas on the inlet to the compressors. Instead of throwing the whole weight of the gasholders on to the compressor inlet, the pressure was reduced by closing-down the valve. The extent of the reduction varies with the position of the holders and ranges from 1 to 3 inches. This has effectively stopped the chattering referred to.

BRIDGE ROAD GOVERNORS.

To accommodate the governors, &c., at Bridge Road an underground chamber was built under the footpath. The general arrangement is shown in fig. 3. Two diaphragm governors of the type shown in section at B C, fig. 4, were installed in tandem—the first designed to break-down the main pressures from 50-in. to 8-in. water-gauge; and the second to govern down from 8-in. water-gauge to the pressures required upon the distributing mains. The governors consist of cast-iron bodies with covers; and the aluminium valves operating inside the governers are of the equilibrium type. These are faced with leather to ensure tightness. The valves are connected to leather diaphragms, which are exposed to the outlet pressure. Should the outlet pressure fall below that for which the governor is loaded, the diaphragm falls and opens the valve to allow more gas to pass through. Should the outlet pressure tend to rise, the action of the governor is the reverse.

PNEUMATIC LOADING.

The first governor B is loaded by lead weights placed on the diaphragm plate. The second governor C is loaded by an air-loading device E, contained in a rectangular cast-iron pillar box F fixed by the kerb of the footpath. This box encases a small water-sealed bell-governor E, whence a pressure pipe is led to the top of the diaphragm of the governor C. The pressure is varied by changing the weights on the governor bell; and it is, therefore, a very simple matter to adjust the outlet pressures, as may be required, from the footpath. The pillar-box also contains three of Simmance-Abady "Dead Beat" pressure recorders for recording the pressures throughout the installation.

BLOW-OFF POT.

To provide against the somewhat remote contingency of both governors simultaneously failing, a 10-in. blow-off pot D is fixed on the outlet of the second governor. This has a water-seal of 6 in., and ensures that in such an event no greater pressure than that of the seal can be thrown upon the distributing mains. The seal is filled through the bent tube G, and overflows through the U-tube seal shown to the elbow syphon H.

VENTILATION.

The discharge from the blow-off pot D is carried by means of a 6-in. steel pipe K (fig. 3) from the chamber to a height of 15 ft. above the roadway level to the underside of the cap above. Coarse wire gauze is placed there to prevent interference with the free working of the shaft, owing to the action of birds. Arranged concentrically with this, and outside it, is a 10-in. steel ventilating shaft J, carried to a height of 9 ft. above the ground level. This shaft is securely anchored in the concrete floor of the sub-station at its lower end, and is firmly gripped by both the concrete roof and the paving of the footpath as it passes upwards. It is thus held perfectly rigid. The section of the shaft within the chamber is slotted, to allow of it sliding over the 6-in. outlet from the blow-off pot D. The exhaust air from the chamber enters the annular space between the two pipes near the roof, and passes away under the lower cap. The webs and distance lugs of this cap serve the double purpose of supporting the cap and keeping the two pipes J K truly concentric. Fresh air is taken to the bottom of the chamber by an air inlet shaft, the top of which is protected by an ordinary perforated lead cap.

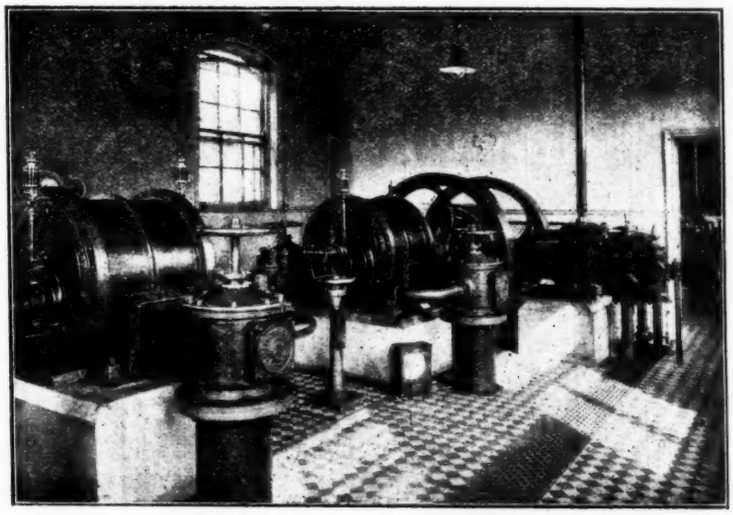


FIG. 2.—INTERIOR OF THE KIRKSTALL ROAD COMPRESSOR HOUSE.

BOOSTING FEED INTO THE DISTRIBUTING MAIN.

Following the blow-off pot a 12-in. feed was taken across the road to the 12-in. distributing main there as shown in fig. 3. The valve at R, together with the inlet valve, enables the whole installation to be isolated whenever necessary.

RODLEY GOVERNORS.

It has already been pointed out that Rodley is supplied mainly by means of a 10-in. independent main. This conveys gas from the Kirkstall Road station to a 12-in. station governor at Rodley, which controls any irregularities of holder pressures, due to variations of stock. This station governor has a tank seal of 22 in. It is obvious, therefore, that when the 10-in. main was supplied, not directly from the holders with a maximum of 8 in. pressure, but from compressors working at anything up to 40 in. pressure, the installation of a check governor became necessary. This is shown in plan in fig.5, and is of the diaphragm type similar to those at Bridge Road. It is designed to break-down the pressure variations to 10 in. As a matter of fact, it is just now weighted to give 7 in. But even this left another danger to be guarded against. It was at least a possibility that at some time when both the station governor B and the check governor A were shut off, there might be small quantities of gas getting through the check governor valve which would in time bank-up between the two governors to such a degree as to blow the water-seal of the station governor. To avoid this, a 1-in. bye-pass C was

CONTINUED ON P. 234.

GAS UNDERTAKINGS (STATUTO

STATEMENT as to Prices of Gas, Cost of Coal, &c., Dividends Authorized and Paid from June, 1914, to December, 1917, relating to Gas Undertak

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	Undertaking.	Total Gas Sold Yearly. Millions.		Price.		Gross Prices Per 1000 C.Ft.									Increase 1918 over June 1914.	Coals and Oil Less Residuals.				Net Cost in		Holders.	
																Half-year June, 1914.		Half-year Dec., 1917.		Half-year June, 1914.		Half-year Dec., 1917.	
						1914.		1915.		1916.		1917.		1918.									
		1913.	1917.	Standard.	Neutral Zone.	June.	Dec.	June.	Dec.	June.	Dec.	June.	Dec.	Jan. 1.		Amount.	Per 1,000 c.ft.	Amount.	Per 1,000 c.ft.	Amount.	Per 1,000 c.ft.	Amount.	Per 1,000 c.ft.
				s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	£	d.	£	d.	£	d.	£	d.
	ENGLAND.															Year to	Dec.	Year to	Dec.	Year to	Dec.	Year to	Dec.
1	Basingstoke	65	84	4 0		3 6	3 6	3 6	3 9	3 9	3 9	4 0	4 0	4 0	6	4,600	15·41	7,946	22·75	9,827	32·93	4,485	41·33
2	Brentford	3,530	4	9		2 4	2 4	2 4	2 4	2 6	2 6	2 10	3 4	3 4	1 0	62,870	8 41	187,152	21·34	107,958	14·45	62,020	*29·86
3	Cannock	81	80	3 6	3 3 to 3 6	3 6	3 6	3 6	3 6	3 6	3 6	3 9	4 0	4 5	11	Year to 3,245	Dec. 9·73	Year to 3,359	Dec. 10·07	Year to 9,087	Dec. 26·77	Year to 10,308*	Dec. 30·92
4	Commercial	3,403	3,683	3 3		2 4	2 4	2 4 and 2 8	2 8	2 8	2 8	2 8 and 3 0	3 2	3 6	1 2	57,152	8·00	119,676	16·22	97,008	13·58	74,670	23·68
5	Gas Light and Coke	27,158	28,373	3 2		2 6	2 8	3 0	3 0	3 0	3 0	3 4	3 4	3 10	1 4	370,327	6·32	695,012	12·48	743,830	12·70	563,552	23·05
6	Hampton Court	221	253	3 6	3 4 to 3 6	2 11	2 11	2 11	3 3	3 3	3 3	3 3	3 6	3 6	7	5,487	10 14	9,678	18·48	8,845	18·52	13,796*	26·12
7	Hastings	452	445	3 10½		2 10½	2 10½	2 10½ and 3 2½	3 2½	3 5½	3 5½	3 8½	3 10½	4 2	1 3½	12,609	13·27	23,177	25·10	16,759	17·64	29,401	31·83
8	Liverpool	4,826	6,023	2 1	2 1 to 2 4	2 1	2 1	2 1	2 1	2 3	2 3	2 4	2 4	2 10	9	Year 197,834	9·38	Year 268,847	10·71	Year 342,894	16 26	Year 264,685	18·52
9	Longwood	123	†187	3 1		2 6	2 6	2 9	3 0	3 0	3 3	3 3	3 3	3 6	1 0	895	3·62	†3,554	9·03	2,810	11·35	†8,537*	21·69
10	Maidenhead	106	128	4 0	4 0 to 4 3	3 4	3 4	3 4	3 6	3 6	3 6	3 6	3 6	3 6	2	2,714	12·07	3,907	13·88	3,889	17·30	6,765	24·03
11	Newcastle-on-Tyne	3,291	4,316	2 9	2 9 to 3 4	2 1	2 1	2 3	2 3	2 3	2 3	2 5	2 6	2 10	9	31,687	4·50	55,583	6·23	69,523	9·86	141,983	15·92
12	Plymouth	1,163	1,305	2 6		1 9	2 0	2 0	2 0	2 0	2 8	2 10	2 10	3 1	1 4	Year to 52,459	Mar 31 10·47	Year to 103,917	Mar 31 19·11	Year to 69,820	Mar 31 13·92	Year to 124,891	Mar 31 22·9
13	Portsea Island	1,427	1,523	3 4		2 4	2 4	2 4	2 4	2 8	2 8	2 8	3 4	3 8	1 4	35,375	11·44	90,052	27·79	60,657	19·6	122,983	37·9
14	Richmond	302	361	3 3	3 0 to 3 3	2 8	2 10	3 3	3 3	3 3	3 3	3 3	3 3	3 9	1 1	5,794	8·98	10,075	13·42	10,419	16·15	18,130	24·1
15	South Metropolitan	13,361	14,225	3 1		2 2	2 2 and 2 4	2 4 and 2 10	2 10	2 10	2 8	2 8	3 1	3 7	1 5	156,489	5·46	393,498	14·0	369,272	12·86	295,280	25·7
16	South Suburban	2,049	2,653	2 9		2 3	2 3 and 2 5	2 5 and 2 10	2 10	2 10	2 10	2 10	3 1	3 6	1 3	41,126	8·90	87,472	16·2	61,149	13·24	128,869*	23·8
17	South Shields	560	565	3 0		2 6	2 6	2 6	2 8	2 8	2 8	2 10	3 4	3 4	10	6,935	5·13	8,095	7·43	17,006	12·59	26,812	24·6
18	Yeadon	100	97	3 0		2 6	2 6	2 6	3 0	2 10	2 10	2 10	2 10	3 0	6	1,409	6·9	1,880	9·6	3,420	16·75	4,779	24·1
19	York	532	543	2 3		2 1	2 1	2 3	2 3	2 7	2 7	2 7	2 7	2 4	3	Year to Dec.'13 9,786	4·41	Year to 17,168	Dec. 7 58	Year to Dec.'13 22,010	9·98	Year to 37,660	Dec. 16·6
20	IRELAND. Alliance and Dublin	1,422	1,378	3 7		3 6	3 6	3 6	3 6	3 6	3 6	3 6 and 4 0	4 0	5 0	1 6	45,103	15·62	43,593	15·57	64,364	22·29	63,487*	22·0
21	Maximum Dividend Companies— Cardiff	1,336	1,468	Max. 3 0		2 5	2 5	2 5	2 9	2 9	2 9	3 0	3 0	3 0	7	26,635	9·01	50,910	16·75	51,144	17 3	80,196*	26·4
22	Garw and Ogmore	19	24	4 6		4 6	4 6	4 6	4 6	4 6	4 6	4 6	4 6	4 6	*Nil*	Year to June,'14 1,346	13·0	Year to Dec.'17 1,772	18·0	Year to June'14 2,014	19·3	Year to Dec. 2,779	27·1
23	Rhymney and Aber	96	123	5 6 4 6 4 0 3 9		4 3 and 4 0	4 0 and 3 11	4 0 and 3 11	4 0 and 3 11	4 0 and 3 11	4 0 and 3 11	4 0 and 3 9	4 0 and 3 9	4 6 and 3 9	3d. in one part decr'ase, 1d. & 6d. in r'm'nder.	1,710	15·10	1,514	25·74	Year 7,729	16·24	Year 8,486	16·7
24	Swansea	533	518	3 6		2 8	2 8	2 8	3 2	3 2	3 4	3 6	3 6	3 6	10	10,832	9·07	19,916	17·10	19,767	16·69	32,641*	28·0
25	Southampton	839	982	3 6		2 10	2 10	3 2	3 2	3 2	3 6	3 6	3 6	3 6	8	12,979	7·61	44,558	21·0	26,272	15·42	64,090*	30·1

Longwood, Columns 3, 18, and 22, includes Slaithwaite.

* Columns 22 and 23 excluding Wages War Bonus.

Short Coal Supply at Oldbury.—It was stated in the course of a meeting of the Oldbury Urban District Council that, owing to the difficulty of obtaining coal, they had been reduced to one week's supply at the gas-works. Unless the position improved, there was a possibility that they would have to shut down.

Sheffield and Coke-Oven Gas.—The Board of Trade have issued the Provisional Order sought by the Sheffield Gas Company to authorize them to construct additional gas-works and acquire additional lands, and make further provision as to the supply of coke-oven gas. The provisions of the Order were outlined in the "JOURNAL" for Feb. 5 last, p. 241.

Burnley and the Maximum Price.—The Burnley Town Council have decided to make application to the Local Government Board for the issue of a Provisional Order to partially repeal, alter, or amend the Burnley Borough Improvement Act, so as to increase the maximum price of gas sold in the borough from 3s. to 4s. per 1000 c.ft.

Blackburn Gas Clerks' Wage Demands.—In response to an application by the National Union of Clerks for an increase in wages of 25s. a week for clerks in the Gas Department, the Blackburn Corporation offered 9s. to clerks up to forty years of age, and 8s. to those not exceeding sixty years. This offer has been refused; and the Union have applied for the matter to go to arbitration.

...S (STATUTORY PRICES).

...ing to ...s Undertakings specified. See Evidence of Mr. W. Cash before the Parliamentary Committee on "Financial Hardships," pp. 238-45 of to-day's issue.

21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
...COST IN...	...HOLDERS.														
...-year ...1914.	Half-year Dec., 1917.		Increase or decrease of dividend per 1d. charged.	Standard.	DIVIDENDS (HALF-YEARLY) ON ORDINARY STOCKS. AUTHORIZED AND PAID (unless otherwise stated). RATE PER CENT. PER ANNUM.									Reduction Jan. 1918, on June 1914, Dividends Authorized.	Reduction Dec. 1917 on June 1914 Dividends paid.	
					1914.		1915.		1916.		1917.		1918.			
					June.	Dec.	June.	Dec.	June.	Dec.	June.	Dec.	Jan. 1			
t.	Per 1,000 c.ft.	Amount.	Per 1,000 c.ft.													
	d.	£	d.	s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	
o	Dec.	...ear to	Dec.													
7	32'93	14,485	41'33	2 6	5 15 0	5 15 0	5 15 0	5 7 6	5 7 6	5 7 6	5 0 0	5 0 0	5 0 0	0 15 0	*Nil*	1
					Pd. 5 0 0	Pd. 5 0 0	Pd. 5 0 0	Pd. 5 0 0	Pd. 5 0 0	Pd. 5 0 0						
8	14'45	662,020	*29'86	A 2 0	A 4 0 0	5 14 0	5 14 0	5 14 0	5 10 0	5 10 0	5 2 0	4 10 0	4 10 0	1 4 0		
				B 2 6	B 3 10 0	5 12 6	5 12 6	5 12 6	5 7 6	5 7 6	4 17 6	4 2 6	4 2 6	1 10 0		2
						Pd. 5 12 0	Pd. 5 12 0	Pd. 5 12 0							1 2 0	
						Pd. 5 10 0	Pd. 5 10 0	Pd. 5 10 0							1 7 6	
o	Dec.	...ear to	Dec.													
7	26'77	10,308*	30'92	3 6	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	5 19 0	5 19 0	5 1 6	1 18 6		3
									Pd. 5 0 0	Pd. 5 0 0	Pd. 5 0 0	Pd. 5 0 0			2 0 0	
8	13'58	74,670	23'68	2 8	4 0 0	5 9 4	5 9 4	4 18 8	4 18 8	4 18 8	4 8 0	4 2 8	3 12 0	1 17 4	1 6 8	4
	12'70	83,552	23'05	3 4	3 10 0	5 6 8	5 6 8	4 13 4	4 13 4	4 13 4	4 0 0	3 13 4	3 0 0	2 6 8	1 13 4	
				2 8	4 0 0	5 1 4	4 16 0	4 5 4	4 5 4	4 5 4	3 14 8	3 14 8	2 18 8	2 2 8	1 6 8	5
5	18'52	93,796*	26'12	2 6	5 0 0	5 17 6	5 17 6	5 17 6	5 7 6	5 7 6	5 7 6	5 0 0	5 0 0	0 17 6	0 17 6	6
9	17'64	29,401	31'83	2 6	§ 3 10 0	5 0 0	5 0 0	4 10 0	4 2 6	4 2 6	3 10 0	3 10 0	3 0 0	2 0 0	1 10 0	7
		Year														
4	16'26	54,685	18'52	2 6	5 0 0	5 0 0	5 0 0	5 0 0	5 0 0	5 0 0	5 0 0	5 0 0	4 5 0	0 15 0	*Nil*	8
0	11'35	18,537*	21'69	2 6	5 0 0	5 17 6	5 17 6	5 10 0	5 2 6	5 2 6	4 15 0	4 15 0	4 7 6	1 10 0	1 2 6	9
							Pd. 5 0 0									
9	17'30	6,765	24'03	2 6	5 0 0	6 0 0	6 0 0	6 0 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	0 5 0	0 5 0	10
			Increase													
3	9'86	41,983	15'92	2 6 bel. Stndrd	3 10 0	4 10 0	4 10 0	4 5 0	4 5 0	4 5 0	4 0 0	3 18 9	3 10 0	1 0 0 On Sept. 1914	0 11 3 On Sept. 1914	11
						Sept.	March.	Sept.	March	Sept.	March	Sept.	Jan.			
to	Mar 31	...ear to	Mar 31	Ord. 2 6	5 0 0	6 2 6	5 15 0	5 15 0	5 15 0	5 5 0	4 15 0	4 10 0	4 2 6	2 0 0	1 12 6	
820	13 9	24,891	22'97	Add 5 0	7 10 0	9 15 0	9 0 0	9 0 0	8 0 0	8 0 0	7 0 0	6 10 0	5 15 0	4 0 0	3 5 0	12
				New 5 0	7 0 0	9 5 0	8 10 0	8 10 0	8 10 0	7 10 0	6 10 0	6 0 0	5 5 0	4 0 0	3 5 0	
57	19'6	22,983	37'96	5 0	10 0 0	13 0 0	13 0 0	13 0 0	12 0 0	12 0 0	12 0 0	10 0 0	9 0 0	4 0 0	3 0 0	
					9 0 0	12 0 0	12 0 0	12 0 0	11 0 0	11 0 0	11 0 0	9 0 0	8 0 0	4 0 0	3 0 0	13
19	16'15	18,130	24'14	2 6	7 0 0	10 0 0	10 0 0	10 0 0	9 0 0	9 0 0	9 0 0	7 0 0	6 0 0	4 0 0	3 0 0	
					5 0 0	5 10 0	5 5 0	5 0 0	5 0 0	5 0 0	5 0 0	5 0 0	4 5 0	1 5 0	0 10 0	14
72	12'86	05,280	25'1	2 8	4 0 0	5 9 4	5 4 0	4 8 0	4 8 0	4 8 0	4 8 0	4 8 0	3 4 0	2 5 4	1 9 4	15
49	13'24	28,869*	23'86	3 4	5 0 0	6 0 0	5 13 4	4 16 8	4 16 8	4 16 8	4 16 8	4 6 8	3 10 0	2 10 0	1 13 4	16
06	12'59	26,812	24'61	5 0	7 0 0	8 10 0	8 10 0	8 10 0	8 0 0	8 0 0	7 10 0	6 0 0	6 0 0	2 10 0	2 10 0	17
				2 6	5 0 0	5 15 0	5 15 0	5 10 0	5 10 0	5 10 0	5 5 0	4 10 0	4 10 0	1 5 0	1 5 0	
20	16'75	4,779	24'4	A 5 0	A 10 0 0	11 10 0	11 10 0	10 0 0	10 0 0	10 10 0	10 10 0	10 10 0	10 0 0	1 10 0	1 10 0	18
				B 3 6	B 7 0 0	8 1 0	8 1 0	7 0 0	7 0 0	7 7 0	7 7 0	7 7 0	7 0 0	1 1 0	0 14 0	
to	Dec.'1	...ear to	Dec.				Dec.							Dec.		
010	9'92	37,660	16'63	2 0	4 0 0		4 4 0	4 0 0		3 12 0		3 12 0	3 18 0	0 6 0	0 12 0	19
															Increase 4 7 6	
64	22'29	63,487*	22'67	2 6	5 0 0	5 2 6 Paid *nil*	5 2 6 Pd. 2 10 0	5 2 6	5 2 6	5 2 6	5 2 6	4 7 6	4 7 6	2 17 6	2 5 0 Dec. on 1915 0 15 0	20
					Maximum									Maximum		
44	17 3	80,196*	26'39		5 0 0	5 0 0	5 0 0	5 0 0	5 0 0	5 0 0	5 0 0	5 0 0	5 0 0		*Nil*	21
	r to June'1	...ear to Dec.'17														
014	19'3	2,779	27'0		Prf. £5 0 0	5 0 0	5 0 0	5 0 0	5 0 0	5 0 0	5 0 0	5 0 0	5 0 0			
					Ord. 10 0 0	10 0 0	10 0 0	10 0 0	10 0 0	10 0 0	10 0 0	10 0 0	10 0 0			
					Ord. 7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0		On Dec.	
						Pd. 5 0 0		Pd. 5 0 0	Pd. 2 10 0	*Nil*	*Nil*	*Nil*			5 0 0	22
						Pd. 5 0 0		Pd. 2 10 0	*Nil*	*Nil*	*Nil*	*Nil*			5 0 0	
ar		Year				Pd. 3 10 0		Pd. 1 15 0	*Nil*	*Nil*	*Nil*	*Nil*			3 10 0	
729	16'24	8,486	16'43		10 0 0	10 0 0 Paid Year. 5 0 0	10 0 0	10 0 0 Paid Year 5 0 0	10 0 0	10 0 0 Paid Year 4 10 0	10 0 0	10 0 0 Paid Year 3 10 0	10 0 0		On year 1 10 0	23
767	16'69	32,641*	28'03		5 0 0	5 0 0	5 0 0	5 0 0	5 0 0	5 0 0	5 0 0	5 0 0 Pd. 3 0 0	5 0 0		*Nil*	24
272	15'42	64,090*	30'19		5 0 0	5 0 0	5 0 0	5 0 0	5 0 0	5 0 0	5 0 0				2 0 0	25

...g Wages War Bonus.

§ Hastings, Columns 24 and 25 3½ p.ct. Standard Stock is 68 p.ct. of the whole.

Gas-Works Seized for Debt.—The Ballinasloe Gas-Works were on Friday last seized for a debt of £800 due to coal contractors; and the Sheriff's bailiff retained possession. The town has been left without lighting.

Lighting of Armagh.—The Armagh City Council have declined the request of the Gas Company for leave to erect poles with a view to carrying out an electric lighting scheme. Mr. P. J. M'Garvey, a member of the Council, said that body had had an electric lighting scheme under consideration some time ago; and he saw no reason why it should not be taken up after the war. In his view, a municipal scheme would be preferable to any other.

Oldham Gas and Coke Complaints.—At the last meeting of the Oldham Gas Committee, Alderman H. Wilde, J.P. (the Chairman), referred to complaints made respecting the quality of the gas in Oldham, and pointed out that it was the very best they could provide out of the low-quality coal with which they were being supplied. As regarded coke, it had been said this was not up to quality, and that the better kind was sent to contractors. This was not true—in fact, those who sent carts to the works secured the best quality. Mr. Tim. Duxbury (the Gas Engineer) said the percentage of ash in the coke was between 20 and 30; whereas in normal times ash only represented some 10 or 12 p.ct.

MR. WALTER HOLE'S PAPER—CONTINUED FROM P. 231.

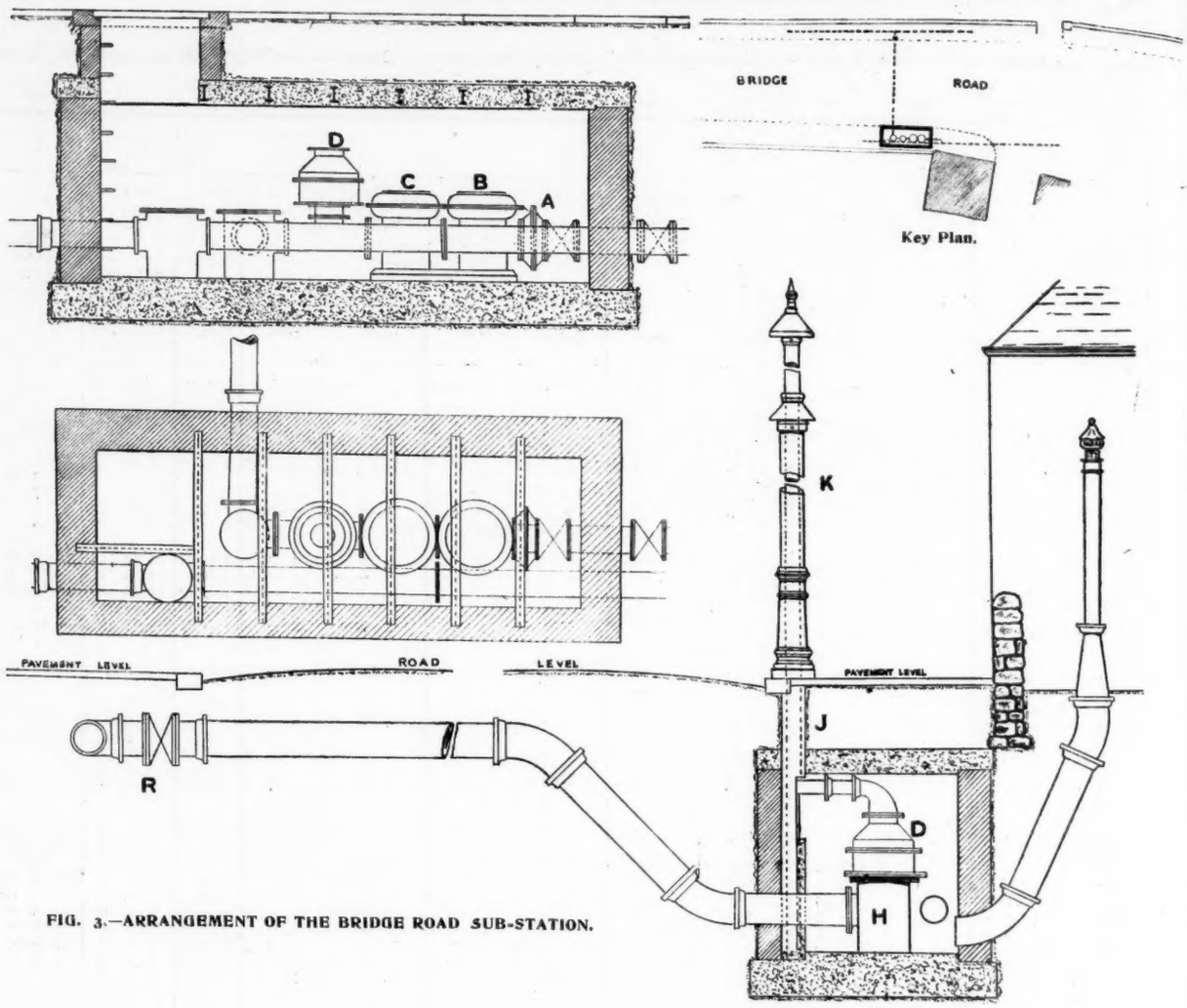


FIG. 3.—ARRANGEMENT OF THE BRIDGE ROAD SUB-STATION.

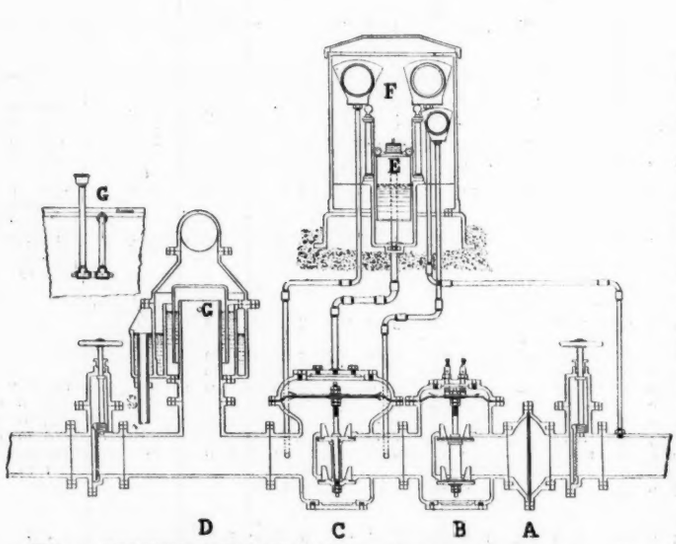


FIG. 4.—BOOSTING APPARATUS AT THE BRIDGE ROAD SUB-STATION.

fitted between the inlet and outlet of the station governor, which bye-pass is controlled by a special governor D designed to open when the pressure on the inlet rises above 7 in. and pass the small quantity of gas getting through the 10-in. check-governor away to the distributing mains. This simple device has worked admirably, and has given no trouble whatever.

Sound Main.

With regard to the independent main which it was proposed to convert into a high-pressure main, two questions required careful consideration. The first was whether we should be justified in assuming that a main which had been in use under a public roadway for over twenty years, and was quite sound at pressures up to 8 in., would be equally sound when used for the transmission of gas at 30 in. to 40 in. This problem could only be solved by a practical test; and it was with considerable satisfaction that we found, when the test was made, that the main proved quite tight at 35 in.

Corrosion in Mains.

The other question which had to be grappled with was how to get rid of twenty years' accretions of corrosion in a main roughly four miles long. It was certain that the corrosion would, in the aggregate, be a very considerable quantity. It was also evident that corrosion which would be stationary in a main when gas was transmitted at the comparatively low pressure of 8 in. would be carried forward by the gas in the increased velocity of travel represented by a rise of pressure from 8 in. to 40 in. Obviously, it would throw the governors completely out of action if the corrosion were permitted to pass forward to the seating of the governor valves. The consequence of such a dislocation would be very serious indeed. The corrosion had, therefore, to be got rid of somehow before the governors were installed. One hampering element in the problem consisted in the fact that the main was in continuous use, and could not be shut-off for more than an hour or two at certain times of the day.

Clearance by Means of Air-Blast.

After fully considering the matter, it was decided to attempt to blow the corrosion forward by means of an air-blast, and do the work in two sections. The section lying between the Kirkstall Road station and Bridge Road was first dealt with. At the latter point, the main was cut early one Sunday morning, and a short length removed so as to give an open end. In order to attain the double purpose of ascertaining approximately the quantity of corrosion blown forward and also of preventing a public nuisance by having it blown right into the roadway, a rough sack was tied over the open end of the main. The compressors at the Kirkstall Road end were then started running at their maximum speed to give an outlet pressure of over 70 in. The result was a veritable "dust up." All the heavier and larger

particles of corrosion were, of course, retained in the sack; but the finer particles blew through the mesh of the coarse sackcloth and were deposited in large quantities upon the side of the trench

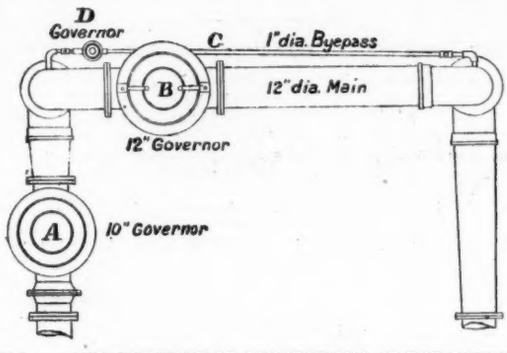


FIG. 8.—ARRANGEMENT OF CONNECTIONS AT THE RODLEY GOVERNOR HOUSE.

and the roadway. Altogether quite a hundredweight of corrosion was in this way blown out of the first section of the main. The additional length of main lying between Bridge Road and Rodley was subsequently cleared in a similar manner.

SCREEN BOX.

In order to still further safeguard the governors a screen box, shown at A (fig. 4), was fixed on the inlet of the governors. The box is made in halves, and suitably recessed for a diaphragm of fine wire gauze of 1-18 in. mesh, which effectually prevents any but the very finest corrosion being carried forward. In the original, the wire gauze was of brass; but this became torn after being in use about two years, and had to be replaced by a gauze of steel wire. During the two-and-a-half years in which the installation has been working, probably some 10 lb. or 12 lb. of corrosion, which had been blown forward, had been taken from the inlet side of the diaphragm.

RESULTS.

With regard to results on the district, the improvement at Kirkstall has been very great, which is shown clearly by comparing two charts which will be shown—one taken before the boosting plant was started and the other after. The improvement may be further illustrated by the increase in output from Kirkstall Road, which in the first twelve months rose from 225,327,000 c.ft. to 290,508,000 c.ft.—an increase of 65,181,000 c.ft., or 28·9 p.ct. The position at Rodley has been very materially improved; and the anxiety as to the adequate supply of this district, which was always acute when the holders at Kirkstall Road were in the first lift, has been absolutely removed. In regard to the entirely new supply (owing to the large number of furnaces put down), we aimed to give a regular 4 in. pressure on the outlet of the meter; and this aim has been most satisfactorily accomplished, as will be seen from the chart.

WORKING.

The details of pressures at which the compressors are worked, naturally vary from week to week, according to the demand for gas. The pressures adopted for the week commencing March 16 were as follows:

5.0 a.m.	18 inches.
5.30 ,,	20 ,,
5.45 ,,	26 ,,
6.30 ,,	28 ,,
11.0 p.m.	26 ,,
11.30 ,,	20 ,,
14.45 ,,	14 ,,
12.15 a.m.	9 ,,

The charts shown give the actual results at the various points of supply for one day in that week.

DISCUSSION.

The CHAIRMAN said they had listened to the paper by Mr. Hole, who was an expert regarding distribution and management, with great interest; and they congratulated him on the way he had overcome difficulties. In the abnormal consumption in the outside area, it must have been very pleasing to Mr. Hole to find that mains after twenty years were tight up to 35 in. pressure. In his own district, they had mains which had lain a longer period than this; and in spite of colliery workings they had found them tight—but not at such high pressure as that mentioned by Mr. Hole. It would be interesting to know what jointing material was used in connection with any new portion of main to be laid. Mr. Hole's method of clearing the corrosion from the pipes was quite satisfactory. The paper was, he considered, full of matters of interest.

Mr. T. HARDIE (Newcastle) said at the present time they experienced much difficulty in supplying districts where munition and other works were to be put down. The difiulties there were in obtaining mains and the necessary jointing material. This made the question all the more important. With regard to the scheme which Mr. Hole had carried out, it was excellent, he thought, and thorough in every detail. As to his arrangement of the tanks for saving water at the gas-engines stationed there, they in Newcastle had done something similar. But instead of using tanks as described in the paper, they had overhead cast-iron tanks. With reference to the "chattering" mentioned, they had similar high-pressure governors for use when they got down to the minimum of supply. The scheme itself seemed to the speaker to be complete in every detail.

Mr. F. C. WILLIS (North Shields) said they at Tynemouth had had a similar problem to meet in regard to outlying districts. Speaking of the internal corrosion of the exhaust pipe, he could quite endorse what Mr. Hole had said about finding particles of rust, &c., in high-pressure mains. They had gone a little further than Mr. Hole in providing not merely screen boxes, or screen castings, of which they had several, but had also put in at the outlying districts screen-syphons—the ordinary syphon with a deflecting plate to trap the particles before they came into the governor station. He would like to ask Mr. Hole if he experienced similar difficulty on the outlet side of his compressor, and whether he had had any trouble due to oscillation. He would also like to ask whether Mr. Hole relied upon the small bye-pass for the supply of the main if the compressor were to stop—that is, to prepare for adequate delivery of gas in such circumstances. He took it the reason that he had not, as it were, "gone the whole hog" and installed a high-pressure system up to 20 lbs. per square inch, was because he was utilizing existing plant and mains, which it might not be desirable to discard altogether. The pressure they were able to place upon an old main spoke very highly of the quality of the work after so many years. They had an intermediate pressure system, but not working to such a high pressure as Mr. Hole had mentioned. In their case, they worked at about 20 lbs.; and for this pressure they found the open type of fan steadier and more perfect than the rotary type of compressor.

Mr. W. D. HELPS (Leeds) spoke as one of the sufferers from want of pressure at Kirkstall, and said he desired to point out that whatever the design might be, Mr. Hole had satisfied the consumers at Kirkstall. As regarded the consumption, this had gone up; but he did not object to that so long as they could get gas to cook the joint and water to boil the kettle. At the same time, when the alteration was made, they altered the time for the payment of accounts—for the good of the city, of course. They paid every three months, instead of every six months; and a record he had kept showed that his three months' account was not less than it was for the six months previously.

The CHAIRMAN: I find from a chart supplied by Mr. Hole that the pressure at your house was 2-in., not counting the hours between midnight and four in the morning, when you would not require gas.

Mr. F. H. ROBINSON (Harrogate) asked what was the length of the sections blown out by compressed air.

Mr. A. C. HOVEY (Sheffield) said he had had before him the question of a station governor being affected by the suction of the compressors, and then passing beyond the governor itself. He took it that Mr. Hole recommended slight wire-drawing. At his works, they installed some five or six years ago, a 6-in. main four miles in length and now on a pressure of 5 lbs. per sq. inch, and they had experienced only very slight leakages, which had been immediately detected and rectified.

Mr. H. H. COLLETT (Leeds) said Mr. Hole had connected a large number of tanks to gas-engines; and it would be interesting to know whether in the cold weather the water had affected the thermal efficiency of the engine. As regarded the corrosion spoken of, he would like to know whether the corrosion was analyzed, and also what steps he took after the blowing out to prevent the formation of an explosive mixture.

Mr. HOLE replied to the discussion. First of all, as to the jointing material of any new main laid in connection with the scheme, he said the jointing material was lead wool. They certainly did have more than an hour or two for blowing-out mains. They had half-a-day. They made a good arrangement for doing this. They did the work on a particular Sunday. Mr. Hardie asked about the manipulation of the valve to stop "chattering." The speaker drew the attention of the meeting to the valve B on the diagram in his paper, and said the only thing they did was to shut down the valve at B so as to wire-pull on the inlet to the compressor. That was to say, when the holders were in the third lift showing 8¼ in., they shut down the valve to reduce the pressure to 7 in.; and when the holder was in the second lift, they reduced the pressure upon the inlet by about 1½ in. The return water asked about by Mr. Collett, no doubt did, in the depth of winter when the weather was very cold, interfere with the thermal efficiency of the engine. It did somewhat reduce its efficiency. Mr. Willis raised the question as to whether the oscillation was found at the outlet of the compressor as well as on the inlet. They had not found this. On a main of four miles long they had a considerable amount of cushion; and this might be the reason for it. They relied on a 12-in. bye-pass to supply the installation for both engines and compressors, and it was not likely from any reason whatever that they would be thrown out of action at one and the same time. As they would see, there must be a limit to this sort of thing. It was conceivable that a dozen might fall out of action, but it was not likely. Mr. Willis had asked why they had not gone in for high pressure, pure and simple. This was hardly a practical proposition when they realized, on the one hand, that it meant laying four miles of main, or, on the other hand, of trusting to the tightness of a main which had been in use for a considerable number of years. Mr. Robinson asked the lengths of the sections blown out by compressed air. The first section was 2600 yards—from the Kirkstall Road gasholder station to Bridge Road; and the second section was about the same. Notwithstanding that the compressors had been working for 2¼ years, they only had 10 lbs. or 12 lbs. of corrosion blown forward to the screen on the inlet to the installation. He would like to congratulate Mr. Hovey on having a low-pressure main now in use at 5 lbs. Along the length of the 10-in. main they had not had a single leakage. They had a strong westerly gale on one occasion, and they got a back action down the vent pipe which blew the water out of the seal. This had never happened since they had fresh caps made. They did not have the corrosion analyzed; and they prevented any explosive mixture forming by blowing the corrosion out. When they got the mains connected-up they left one of the bags in and blew the air out.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Quality of Gas Supply under War Conditions.

Sir,—There would seem to be an impatience on the part of public authorities with the quality of the gas supplied by gas companies in the disturbed conditions engendered by the war.

The physical difficulties commonly involved may, I think, be stated as follows:

1. Deficiencies in the quality and quantity of materials, as obtainable, and in labour.
2. Inadequacy of manufacturing plant and storage.
3. The simultaneous production of distillates for munitions of war.

I would like to say at once that, where the plant and materials available are sufficient for the dimensions and character of the supply in case (with a reasonable degree of prospective security) it seems to me neither equitable nor wise to distribute, to an appreciable extent, incombustible ingredients in the gas supplied for the sake of commercial advantage or, indeed, any minor economy.

There are, however, instances to be considered where the materials of all kinds are inadequate, both in quantity and quality, for the duty involved; where labour and plant are alike unequal to the demands upon them; and where the Government requirements for distillates are superadded to such disabilities.

In these circumstances it appears to me that the technical policy of the undertaking must be directed to extracting the uttermost amount of combustible constituents from all the available material, without regard to the involved presence of inert products, for distribution at such a pressure that it can be efficiently used by the consumer.

I would emphasize the concluding words of the last sentence, because I believe that every gas engineer with practical experience will agree with me that, in anything like comparable degrees, pressure is of vastly more practical importance to the consumer than quality.

If, for the sake of an academic regard to quality and the absence of inert ingredients, the volume produced is restricted to the point at which some combustible elements are not extracted from the coal, and at which the quantity made is less than necessary to maintain an effective pressure at the limits of a district, then the policy fails, I think, to meet the emergency, and is against the interest of both company and consumer.

In these days of incandescent lighting and the general use of the bunsen burner, a high quality of gas at a defective pressure will distress the consumer far more than a gas, at a good pressure, much below the calorific value that he is entitled to expect.

I am as much as anyone against the sale of what is not gas for what is understood to be gas. It is neither honest nor excusable as a procedure in normal times but—"*Necessitas non habet legem;*" and in these times we must do what is best in the public interest, without pedantry.

These are not days in which we are disposed to learn from our arch national enemy; but the "Children of Mammon" can, on occasion, teach the "Children of Light" something. I am told that, considering the same general situation in the same qualifying circumstances, the German gas-experts decided upon the relative advantage of a complete supply of a low-quality gas as against an incomplete and discontinuous supply of a higher quality.

A. M. Paddon.

4, *Brick Court, Middle Temple, May* 1, 1918.

Low-Temperature Carbonization and Oil Production.

Sir,—As one who has had some considerable experience in low-temperature carbonizing, the writer is naturally greatly interested in the efforts now being made by Sir Arthur Churchman, representing the Ministry of Oil Production, and his experts, to convert high-temperature vertical gas-works retorts into low-temperature oil-producing retorts. Speaking from experience, my impression is that they will fail.

The idea is to convert the retorts into oil-producers at the top and gas producers at the bottom. To heat a retort only 15 ft. or even 20 ft. high into well-defined and well-maintained graduated zones will prove a very difficult matter—especially so when the extreme temperatures must range from 1000° Fahr. and under at the top and over 2000° Fahr. at the bottom—because the tar oils are only produced in quantity and quality at a temperature of 1000° Fahr. and under; whereas to obtain from 12,000 to 13,000 c.ft. of gas per ton, steam must be admitted. This would be useless for increasing gas production if introduced into a zone heated to less than 2000° to 2200° Fahr.; and it is difficult to imagine how this extreme range of temperature can be maintained in such a limited height. What is more, the writer does not understand how, with a continuous and graduated heated retort, the time of travel of the sticky portion of the charge in the upper portion of the retort can be made to synchronize, as regards travel, with the contents of the highly-heated lower portion.

A combination of a high-temperature gas-producing retort with a low-temperature oil-producing retort is in the opinion of the writer incompatible.

The effort now being made by the authorities is a panic measure (and, goodness knows, they have been warned frequently enough for some years past) simply to obtain oil. But, commercially speaking, no process for obtaining oils from coals or cannels can be successful which disregards the production of a useful coke fuel—especially if it be a flammable coke containing 10 p.ct. or so of volatile matter.

The writer's opinion is that much time and money will be spent in endless experiments, and in tinkering with the existing retorts, and after all the results are doubtful.

He knows the position the authorities take is that to construct new works on a low-temperature carbonizing plan would cost too much time and money, and especially the difficulty of obtaining steel, &c., for building purposes.

But there was a happy medium suggested to them, and that was to put the low-temperature men in possession of certain retort-houses, and let them convert the high-temperature benches into low-temperature ones, whereby practically all the metal and brickwork could have been utilized, and the only question would have been the casting of the cast-iron low-temperature retorts.

Had the authorities listened to this three years ago, as they were urged to do, the present panic measures would have been avoided, and absolute success would have been obtained.

Appended is a tabulated statement of results extracted from a

Extract of Results obtained by Low-Temperature Carbonizing at a Temperature under 1200° Fahr.

Name of Coal.	Analyses. Coal. H_2O	V.M.	F.C.	Ash.	N.	Tarless Fuel. H_2O	V.M.	F.C.	Ash.	N.	Yields per ton of coal carbonized. A Spirit.	Light Oils.	Heavy Oils.	Total Oils.	Tar Acids, Cresylic.	Pit Pitch.	Sulphate.	Tarless Fuel.
											Galls.	Galls.	Galls.	Galls.	Galls.	Cwt.	Lbs.	Cwt.
Ballengleich (Natal)	3·34	25·10	53·65	19·0	..	3·7	9·85	63·11	23·34	..	3·25	3·9	4·0	15·2	1·8	0·34	36·5	16
Forest of Dean	3·1	31·2	58·57	7·0	..	dry	12·9	78·4	8·7	..	2·0	5·7	5·4	15·2	..	..	13	15·9
Hulton	dry	34·73	50·06	7·21	..	dry	8·26	82·85	8·89	..	0·83	4·9	7·9	18·4	..	..	20·7	14·7
Maltby Main	13·0	29·2	..	8·9	..	..	..	..	11	..	4·50	5·7	4·7	16·3	..	..	9·5	14·5
Silkstone, Beanshaw	..	30·9	..	..	..	..	8·0	81·6	10·4	..	5·06	6·0	6·1	17·2	..	..	..	..
Silkstone, Winter Slack	dry	32·85	58·31	8·84	..	dry	7·71	82·3	9·99	..	0·4	4·4	10·5	19·8	..	..	12·1	15·5
Silkstone, Two Foot Slack	dry	32·96	57·39	9·65	..	dry	8·08	75·52	16·4	..	0·5	5·0	11·0	22·0	..	..	10·91	15·75
Niddrie Cannel	dry	50·87	44·4	4·73	..	..	..	..	..	..	5·0	12	19	..	..	2·37	17·4	10·0
Newbattle Cannel	1·14	50·23	44·06	4·33	..	..	..	..	..	..	5·0	13·5	28·5	..	..	2·06	21·8	10·0
Hucknall Belt Pickings	3·8	21·2	43·7	31·0	..	..	..	..	34	..	2·2	7·52	2·27	14·2	..	0·39	11·0	14·4
Sulphide Corporation, (Australia)	2·08	31·8	55·9	8 43	1·75	..	10·3	75·4	18·26	1·95	5·37	..	8	16·4	..	0·67	19·8	15 5
Bignall Hill Washed Pearls	..	..	..	5·4	..	..	..	..	7·4	..	2·5	5·7	4·0	22·0	..	0·8	23·8	14·0
Tilmanstone (Slack) Kent Coal	..	..	..	..	..	..	..	..	12·5	..	2·5	6·0	4·5	20·3	..	63·5 p.ct.	22	16
Snowdon (Kent Coal)	..	..	..	..	..	..	..	.	13·8	..	3·0	8·0	3·9	17·3	..	62·0 p.ct.	19·2	16
Stanton Iron and Coal Company (Cannel)	..	..	..	..	..	..	..	..	..	..	7·6	7·92	11·88	44·0	3·08	..	25·33	10
Wigan (Cannel)	1·64	57·82	36·61	3·93	..	2·25	7·96	82·77	7·02	1·30	6·8	14·7	44·7	85·1	8·0	1·15	22·0	10
Lignite (Spanish)	5·24	35·74	..	9·99	1·30	..	12·50	15·60	..	1·24	2·2	4·4	6·95	22·71	..	..	18·5	11
Shale (Spanish)	..	..	..	..	..	..	..	..	..	..	1·1	1·2	17·00	30·1	..	..	19·1	worthless
Glapwell (Slack)	..	..	..	..	..	..	..	..	..	..	3·54	5·03	5·40	17·96	13 0	..	18 6	16
Glapwell Nuts	..	..	..	..	..	..	..	..	..	..	4·39	10·17	8·39	28·69	..	..	10·2	15·5
Tyne Boghead Cannel (Mickley)	..	..	..	..	..	..	..	..	..	..	3·12	14·9	19·94	53·5	..	..	23·0	14·0

NOTE.—In addition to the production of spirits (petrols) obtained from the fractionation of the tar oils, an additional 2 to 4 gallons per ton of coal carbonized will be obtained by "stripping" the rich gas which must be added to that tabulated in this statement under Column A.

***Cokes.*—The cokes contain from 7 p.ct. to 12 p.ct. of volatile matter.**

***Tar Oils.*—These fractionate into tar acids (cresols), and represent (approximately) 7 p.ct. to 14 p.ct. of the crude oils. The oils contain 5 p.ct. to 8 p.ct. of paraffin wax.**

number (over 200) obtained by carbonizing by low-temperature coal, cannels, and shales, colliery belt pickings, &c., &c., from all parts of the globe, which have been educed by patient trials during the last five to six years; and the writer challenges Sir Arthur Churchman, as representing the Government in this matter, to produce similar results by his method of tinkering high-temperature gas-works retorts into low-temperature oil-producing retorts.

Sir Arthur Churchman is well aware, from the trials his experts have conducted on a certain low-temperature carbonizing plant erected on a commercial scale, that the results tabulated can be obtained, and these from a plant in a time-worn condition. From one cannel his Department sent to be tested, 44 gallons of crude oil per ton were obtained, and 16 cwt. per ton of an excellent flammable coke.

I do not think he will obtain a similar result from the converted gas-retorts—certainly not 16 cwt. of flammable coke from this particular cannel.

F. D. MARSHALL.

19, *Queen Anne's Chambers, S.W.*1, *May* 2, 1918.

Coal and Gas Rationing.

SIR,—I thought perhaps you might like to publish the enclosed letter, which I have just received, and which is an illustration of my recent contentions.

H. O. CARR.

Wandsworth, April 30, 1918.

[ENCLOSURE.]

The letter is from a householder at Clapham, and is as follows:

Noticing your remarks in the "Evening News" *re* "Coal and Gas," I thought you would be interested in my figures as set out below.

I may say, at the request or suggestion of the Coal Controller and Gas Company, I, in June last, at some expense, installed a gas-heating stove in place of a coal fire. My economy in electricity has resulted in my account falling last year below the minimum, which I had to pay, and now it seems my economy in coal, resulting in an increase in gas, is to subject me to a fine. I may say I have a gas-cooker, gas-copper, and two gas-heated rooms, and, according to the Coal Controller's system of calculation, have five occupied rooms with coal fires (if any).

Coal, Gas, and Electricity Calculated as Coal Used.

	Tons.	Cwt.	Qr.
Coal allowance per annum	3	18	0
Gas " " . 23,583 c.ft. =	2	0	3
Electricity " " . 120 units =	0	4	1
	6	3	0

Actual Consumption, March, 1917 18.

Coal	1	0	0
Gas, 27,900 c.ft. . . . . =	2	8	0
Electricity, 65 units . . . . . =	0	2	1
	3	10	1

I am therefore 2 t. 13 c. under my coal allowance on all three items; but, owing to exceeding on gas, I shall be penalized, and also punished by paying the minimum charge for electricity.

Owing to war conditions, my family is reduced to two; but even for a family of four or five, the coal allowance is ample. But it is most illogical to take one of the three coal-using services alone. They should all be taken together; otherwise it cannot be wondered at people giving up gas for coal, which, if I am fined, will certainly be done in my case.

I understand the Coal Controller is somewhat belatedly awakening to these facts; and I hope, if you have any influence, it may be used to bring about a commonsense system as you suggest.

I have taken the gas production at 11,600 c.ft. per ton, and electricity at 1 unit for 4 lbs., which I believe to be a fair average.

The Wages Question.

SIR,—Your correspondent, Mr. Thomas Newton, has raised a number of unsolved problems respecting the wages question, with special reference to the gas industry. Now that the national award has been made, we ought to spend the breathing time wisely by taking thought for the morrow.

The case of municipally owned gas undertakings presents a double problem. It is common experience that a settlement in one department of a corporation unsettles all other departments, until uniformity is again established. To a larger extent and on a wider scale, and therefore by a slower process, any national settlement of wages in a particular industry is bound, in the long run, to affect other industries —*e.g.*, engineers' awards and the notorious 12½ p.ct. bonus. The spirit of "enlightened self-interest" in the various labour organizations is too great for any Committee on Production under present conditions; and the Committee is bound to give way before superior forces.

The wages question can be roughly divided into three main heads:

1. Adjustment of wages to a depreciated currency.
2. The effort of organized labour to improve the status of the workman.
3. Special points in particular industries—such as overtime rates, Sunday labour, hours of labour, and general conditions of service.

The first essential to a settlement is an authoritative statement periodically issued by the Government, as to the actual increase in the cost of living—having regard to substitutes and the quantities of food available. I do not under-estimate the difficulties of the Government in preparing such a statement, which must be accepted by employers and workpeople. Nevertheless, it ought not to be shelved because it is difficult. With this figure before them, all Industrial Councils would periodically adjust the rates of pay automatically in their particular industries on pre-war rates. There would then be no glaring differences in the treatment of skilled, semi-skilled, and unskilled grades of workpeople.

Problem number two has to some extent been dealt with by the Government awards. No one seriously contends that the 12½ p.ct. bonus has been granted on account of the increased cost of living. A further renewal of the effort will recur in time; and the question could be dealt with in each industry along with problem number three, on the lines of the Whitley report. The Executive Committee of the National Gas Council seems to be very well adapted for this purpose; and some scheme could be formulated whereby the workman would become a more efficient unit in the production and distribution of the commodities produced. Any alteration on these grounds would be particular to the gas industry; and the workmen in other departments of corporations could hardly claim to follow, since the conditions would be dissimilar and the workmen in those departments would not be in a position to fulfil their side of the arrangement. This method of procedure would require some thinking-out, because I am fully aware that many questions arising out of this division could be better dealt with by a particular gas undertaking and the local Union of the men concerned.

I have only dealt with what seems to me to be the main considerations; but if these questions could be systematized, I feel sure we should have made real progress with a complex question.

J. H. SILLITOE.

Manchester, May 2, 1918.

LEGAL INTELLIGENCE.

Alleged Mantle Ring Conspiracy.

Nottingham Magistrates investigated a case, on Monday of last week, in which Cornelius John Sutton, a gas-mantle manufacturer, of Bolton, and Alice Sharp and Linda Draper, female munition workers, were charged with conspiring to solicit Miss Elizabeth Herman, an employee of Messrs. W. A. Ward & Co., of Nottingham, to steal fire-clay and other materials from that firm. It was stated that the prosecutors claimed to have discovered the process of making gas-mantle rings hitherto exclusively possessed by the Germans. Sutton was to a certain extent a competitor; and he was apparently anxious to secure the prosecutor's idea with regard to the rings. Mrs. Sharp, who was his cousin, was alleged to have got into communication with Miss Herman, who was employed by the prosecutors as a sorter, and asked her for certain materials. Herman, whose conduct throughout was exemplary, informed the Managing-Director, and Sutton was supplied with "duds." Sharp afterwards made gifts of money and other things to Herman, which the latter handed over to Mr. Ward. The charge against Draper was dismissed; the two other defendants being committed for trial, with bail.

Fines under the Shop-Window Lighting Order.

The attention of Magistrates in London is beginning to be taken up by offenders against the shop-window lighting restrictions. At Hendon, the manageress of a costumier's establishment was proceeded against for having had six electric lights of about 30 to 40 c.p. each burning at the establishment. The Chairman of the Bench (Sir William Crump) said the full penalty was £100; but in view of the fact that it was the first case, the fine would be only £5. The Bench wished it to be understood that the Order must be obeyed, and that contravention in future would be very heavily punished. A number of tradesmen in Islington were, at the North London Police Court, fined for using gas or electric light in their shop windows contrary to the Order of March 25. The penalties varied from 2s. costs to 20s.

Gas and Coal Allowances.

The attention of the Board of Trade has been called to the action of some householders in giving up gas and electric fires and cookers, owing to the restrictions imposed by the new Order with regard to the quantities of gas and electricity used. The Board warn consumers that an Order will shortly be issued restricting household supplies of coal, and that under this Order regard will be had to gas and electricity consumption in fixing the allowance of coal. The comment of the "Star" is: "The consumer is becoming like flying-fish, pursued from sea to air and back again by relentless officials. The Board of Trade have discovered that householders are giving up gas and electric fires and cookers, owing to the restrictions of the Lighting Order, 1918; and they warn consumers that an Order will shortly be issued restricting household supplies of coal. Whichever way the unfortunate consumer turns, the official harpoon is ready. A year or two ago there were frantic appeals and orders to the consumer to instal gas-stoves. He was to burn gas, in order to help the Munitions Ministry to get the ingredients of explosives, and, at the same time, to reduce the transport of household coal. Then when the consumer had meekly spent a few thousands on gas fires and stoves, the officials produced the Order which cut down the quantity of gas and electricity in order to save coal. This was only done in the South of England. In the North, they either do not want to save coal or they produce gas and electricity without coal. The consumer ceased using his gas-fire, and began to buy coal; but the officials are ready for him. They are going to reduce his coal ration in proportion to the amount of gas and electricity he uses. If he goes out, he finds the theatres, hotels, and restaurants shut; and returns home to find that the South Metropolitan Gas Company are sending out on the back of their demand-notes advice to instal more gas-stoves, while their inspectors are calling round to warn him against using so much gas."

THE "FINANCIAL HARDSHIPS" BILLS.

PROCEEDINGS BEFORE THE HOUSE OF COMMONS COMMITTEE.

The Select Committee appointed by the House of Commons "to consider and report whether it is expedient that some provision should be made for the temporary modification of statutory requirements with regard to price and dividend in the case of gas undertakings whose financial circumstances have been injuriously affected by causes arising out of the war, and, if so, on what terms and conditions, and whether by Private Bill or General Legislation," commenced its sittings on Tuesday last.

The members of the Committee are: Sir William Middlebrook, Mr. Acland Allen, Mr. Anderson, Mr. Allen Baker, Mr. Field, Mr. Fletcher, Mr. Macmaster, Mr. Robinson, Mr. Stewart, and Captain Barnston.

Questions of Procedure.

The Committee met at 11 a.m. to choose a Chairman and consider the course of business. When the parties were admitted into the Committee room at 11.30, it was seen that the Committee had selected Sir William Middlebrook as their Chairman.

The Chairman said he understood that there were at present no fewer than 25 Bills before Parliament affecting the question set out in the reference to the Committee; and it would be a herculean, if not an impossible, task to have representatives of each one of the promoters before the Committee separately. The Committee had come to the conclusion that the best course of procedure would be to hear, first, Counsel and witnesses on behalf of what he might term the gas undertakings—company or municipal—who were seeking or desired a modification of their statutory terms. These should be heard by one set of Counsel and one set of witnesses; and the chief ground of opposition should also be heard through one set of Counsel and one set of witnesses. If there were other interests involved to justify a separate appearance from other opponents, and the grounds could be distinguished from the others, application would have to be made, and the Committee would then consider whether or not these applications could be granted.

Mr. Honoratus Lloyd, K.C., speaking on behalf of the promoters of all the Bills, said that the arrangements which the Chairman had outlined were rather what had been thought would be the view of the Committee; and they had acted on this assumption.

Mr. Clode, K.C., said he appeared, with Mr. Freeman, K.C., for the London County Council and the Association of Municipal Corporations, which latter represented corporations not owning gas undertakings. Up to the present they had tried to follow the lines indicated by the Chairman, and to bring all their opposition into line. He would not like, however, at the present moment to say that they had succeeded, because there were many points that could possibly be brought forward by corporations not owning gas undertakings which might not be covered by what he might call the general case. Therefore he would like to reserve the right to take part in any discussion on points of detail.

Mr. Courthope Munroe said he represented the Gas Companies' Protection Association, and desired to ask the Committee to allow him to be heard on the general scheme of whether relief should be given to gas companies. If the Committee decided that relief should be given, there was the further question as to whether it should be by Private Bill or general legislation. In addition to the 25 Bills represented by Mr. Honoratus Lloyd, there were hundreds of gas companies in the country which might be affected by the Committee's decision; and, speaking generally, there was no body which represented gas companies to the same extent as the Gas Companies' Protection Association. If it was decided to give relief, he desired to be heard on the form of it.

Mr. Szlumper said he took it that the Committee had not been formed for the purpose of dealing with anything in the particular Bills. The companies represented by Mr. Honoratus Lloyd were a very small minority of the gas companies in the kingdom, and there were a large number of them whom the evidence offered by Mr. Lloyd would not suit at all. He appeared on behalf of a number of gas companies who had not promoted Bills, but whom the decision of the Committee would vitally affect. Therefore, he asked the Committee to consent to his remaining, and, if the necessity occurred, to hear evidence with regard to the small companies.

The Chairman said the Committee had no objection to the presence of other Counsel. It would be a question of deciding as to their intervention later.

Mr. J. W. Jeeves, on behalf of the Cardiff Corporation and the Twickenham Urban District Council, asked to be allowed to appear as against the Bills of the Cardiff Gas Company and the Brentford Gas Company. In the case of Cardiff, the Corporation felt strongly that there were special circumstances as to the management of the Cardiff Company which they thought it was essential in the interests of the consumers the Committee should have before them. As to the Brentford Company, there were very special circumstances with regard to capital expenditure and the operation of the sliding-scale by which certain results had been obtained which were altogether different from those secured by many other companies, all of which were matters which the Council felt very strongly should be placed before the Committee. Therefore, he asked to be allowed to watch the proceedings, and, if necessary, apply to intervene.

Mr. H. Lang Coath (Town Clerk of Swansea) asked that a similar privilege should be accorded the Swansea Corporation, who at the moment had not Counsel present on their behalf. Other large corporations, such as Liverpool, were in opposition; and he asked for the same rights that were granted to them. He was under the impression that the Association of Municipal Corporations, to which Swansea belonged, was to represent all the local authorities not owning gas-works. Therefore Swansea had not at the moment come with their own Counsel and witnesses.

Mr. J. W. Bailey said the local authorities whom he represented claimed to have had exceptional parliamentary bargains with their gas companies; and he desired that no pronouncement of the Committee should go the length of prejudicing the case he would put before the Select Committee of the House which dealt with these Bills. The authorities he represented were Rhymney and Slaithwaite.

Mr. Pritchard (Parliamentary Agent) said he represented Leeds, Blackburn, Burnley, and several other large towns owning gas undertakings, and asked for leave to appear by Counsel. He did not understand that Mr. Honoratus Lloyd represented any local authorities.

Mr. Honoratus Lloyd: No.

Mr. Pritchard said that, on the whole, he did not think there was any great contest between his clients and the promoters, whereas between the gas companies and the local authorities not owning gas undertakings there was considerable contest.

Mr. Honoratus Lloyd said he represented the companies promoting the 25 Bills. At the same time his instructions emanated largely from a source which had considered the whole matter after meeting not only company representatives, but also representatives of the local authorities owning gas-works; and he could hardly open his case for the companies without calling attention to the local authorities who owned undertakings, and who were suffering hardship in the same way as the companies. With regard to the suggestion that the urban district councils should be heard separately, he deprecated this because, although he was going to argue that relief should be given, he was not prepared to say the measure of the relief that should be given to particular companies. If the proceedings were to be complicated by each individual council being heard, he ventured to think it would not carry the Committee very much further, because he himself would start off by saying that there were cases in which it might not apply. It might be in the interests of Counsel that they should watch; but he hoped they would watch at a distance, and not take an active part, because he ventured to suggest that the question as to whether relief should be given in a particular case did not arise before the Committee.

The Chairman said he thought for the moment the wisest course would be that they should accept the appearance of Mr. Honoratus Lloyd, and those with him, for the promoters of the Bills and Mr. Clode, and those with him, as representing the interests on the other side—reserving the applications that had been made in other interests for consideration later. The principle on which the Committee wished to proceed was not to consider individual cases and the variations that might apply in different cases, but to define some method of dealing with the question as a whole—that method being sufficiently elastic to enable the differences of different companies or local authorities to be fairly and properly adjusted. Therefore, at the moment, they would take the ordinary course and hear Counsel on behalf of the promoters, and then Counsel on behalf of the opponents.

The Counsel appearing are as follows: For the promoters of the 24 Bills and one Provisional Order, Mr. Honoratus Lloyd, K.C., Mr. G. J. Talbot, K.C. Mr. Vesey Knox, K.C., the Hon. Evan Charteris, and Mr. F. N. Keen; the London County Council, the Association of Municipal Corporations, and local authorities not owning gas undertakings (instructed as to the latter by the Town Clerk of Swansea), Mr. Freeman, K.C., and Mr. Clode, K.C.; the Gas Companies' Protection Association, Mr. H. Courthope Munroe, K.C.; the Cardiff Corporation and the Twickenham Urban District Council, Mr. J. W. Jeeves; the Rhymney and Slaithwaite Urban District Councils, Mr. J. W. Bailey; other parties, Mr. Szlumper and Mr. Pritchard (Parliamentary Agent).

The Case for the Promoters.

Mr. Honoratus Lloyd, K.C., opening the case for the promoters, explained that there are 24 Private Bills and one Provisional Order (which had already been prepared in draft by the Board of Trade and was awaiting confirmation by Parliament). He desired to place before the Committee the financial circumstances which had arisen out of the war and which had injuriously affected all the promoters, inasmuch as there had been a very large increase in the cost of manufacture of gas such as was never contemplated or dreamed of when the existing statutory provisions with regard to price and dividend were enacted. These circumstances were entirely out of the control of the companies. He explained the operation of the sliding-scale and the differences between a statutory gas company and an ordinary commercial undertaking and, indeed, any other statutory company having regard to the manner in which prices and dividends were either fixed or arranged so that an increased price resulted in a decreased dividend. Other statutory concerns had, however, already received relief at the hands of Parliament from burdens placed upon them owing to the war; and Counsel mentioned railway companies and dock and harbour undertakings. Within the last few days, a Committee had been appointed to consider the same question in regard to tramways; and he understood the matter was also to be considered in regard to electric light undertakings. He believed that the Board of Trade had appointed a Committee of experts for certain purposes, and one of the items was to consider cases of revised charges which might be referred

to them. Furthermore, under the Electric Lighting Acts there was power to revise charges which did not exist in Gas Acts. Finally, the case of water undertakings was likely to come under consideration; and the Hoylake and West Kirby Company had applied to the Board of Trade for a Provisional Order to enable them to increase their charges. The importance of the gas industry could be gathered from some figures from the Board of Trade returns for 1913, which were the last available. From these it was seen that there were 519 companies with a combined capital of £102,213,000, and 312 local authorities representing a capital of £26,173,000, or a total of 831 undertakings with a capital of £128,386,000. Nor need he remind the Committee of the value of the gas industry in regard to the services which it performed. There never had been a time when it had been of greater use to the country than during present circumstances. Unfortunately, the position of the gas industry during the war had got worse and worse; and the result was that it received consideration from a body known as the National Gas Council, which represented both company and local authority interests. The National Gas Council were so impressed with the hardships which now existed, that they obtained an interview with the President of the Board of Trade on Oct. 24 last, and subsequently the 25 Bills were deposited in Parliament. The present Committee were appointed on March 30; and he desired, on behalf of those whom he represented, to express their gratitude to the House for the opportunity of laying their case before such a tribunal.

It would be idle to endeavour to deal with the matter unless he gave shortly the history of gas in this country, particularly in relation to charges and dividends. The history in relation to these particular points could conveniently be divided into three parts. The first was the period of competition; the second was the period of statutory regulation of dividends and regulated monopoly; and the third was the period after which the sliding-scale was introduced. It would so happen that in dealing with the history he would mention most frequently the London Companies. This would not be because he regarded these as differing in any material respect from the Provincial undertakings, but because the various stages were marked by reports and recommendations made by important committees which had dealt with questions arising in connection with the London Companies.

The period of competition could be said to have existed from early in the last century—1812 down to 1860. In those days powers were granted, particularly in the Metropolis, which overlapped in districts, and the companies were allowed to make what profit they could. There was no limit as to the profit they might make or the price they might charge; and in the early part of the period in question the companies were under no obligation to supply. In 1842 and onwards, however, Acts began to be granted by Parliament prescribing the limitation of dividends; and the figure almost invariably adopted was 10 p.ct. As these Acts got numerous, and long clauses were oft-times repeated in them, the Gas-Works Clauses Act was passed in 1847 which was embodied in the Special Acts. Clauses 30 to 38 dealt specially with the question of dividends and price. The Gas-Works Clauses Act also allowed the formation of a reserve fund up to 10 p.ct. of the capital, for the purpose of making up the prescribed rate of dividend and for extraordinary claims, when certified by justices. So far as he knew, this was the first attempt to deal with the question, because in the Act it was laid down that when a company had paid its 10 p.ct. dividend and the reserve fund was up to the full amount, an application could be made to Quarter Sessions by the consumers for a reduction in the price; so that the revenue should not exceed the amount required for the purposes in question. He did not know that history had shown this remedy to be very effective. In 1850, the maximum price began to appear for the first time, and soon became common.

The competitive system had many disadvantages. In the first place, all the companies laid mains in those districts where they thought there would be the most customers; the result being that the length of mains laid per customer was very large indeed. At the same time, the return, owing to the customers being distributed among so many companies, was most unsatisfactory. Nevertheless, the supply to the consumer was poor, and general dissatisfaction arose. To borrow a phrase in a Board of Trade report about that time, the system was "ruinous as well as impracticable." In addition to the unsatisfactory financial position, there was also the trouble caused by several companies breaking-up the roads in order to discover a leak—it often happening that each one would replace the road for the next one to break it up again very shortly afterwards. Hence the dissatisfaction became very great. This continued for a great number of years. In 1853, however, the Metropolitan Companies—there were thirteen of them—endeavoured among themselves to minimize the difficulties that existed, and entered into a scheme of districting London; so that there should no longer be overlapping areas. This was satisfactory to all parties; and the passing in 1860 of the Metropolis Gas Act, which applied to all the thirteen companies, was the beginning of what he had ventured to call the second period.

That Act, instead of allowing the companies to pay their maximum dividend and make up arrears of past years without limit, restricted the payment of back-dividends to a period of six years. It also sanctioned the districting of London, placed upon the companies an obligation to supply, and fixed a maximum price at 4s. 6d., which was to prevail unless an increase in cost rendered it advisable that the price should be increased, in which case it was not to exceed 5s. 6d.

This, however, was not altogether successful, because there was general complaint that the price charged was unnecessarily high; and in 1866 the Corporation of London promoted a Bill to enable them to supply gas in the City in competition with the existing City Company. A Committee was appointed, presided over by Sir John Trollope, with an instruction to inquire as to the working of the Act of 1860. The City Corporation Bill was rejected; but the Committee reported in favour of districting and regulated monopoly, and recommended that the Government should introduce a Bill. In 1867, the Government did introduce a Bill; and in the same session were promoted other Bills, which were all referred to a Committee of which the then Mr. Cardwell was Chairman. The Government Bill was dropped, as also were the others; but the Committee presented a report of considerable importance, to the effect that the 1860 Act had been eminently favourable to the companies, and that the interests of the consumers had been very inadequately protected. The Committee suggested that effective regulations should be applied by Parliament having regard to the due care and management of the companies' administration. The Committee further suggested periodical revision of prices. In 1868, a Bill was presented by the Corporation of London to amend the Act of 1860, on the lines of the Cardwell report; and Mr. Cardwell himself presided over the Committee who were appointed to consider the Bill. The measure was eventually accepted by the then three city companies, and was passed—being limited in its operation to the City of London. The Act provided for amalgamations with a view to producing economies, and prescribed a maximum price of 4s. per 1000 c.ft. for 14-c.p. gas, and subsequently 3s. 9d. for 16-c.p. gas. It further provided for a maximum dividend of 10 p.ct., and an insurance fund up to 5 p.ct. of the capital. In 1868 also, one of the companies now amalgamated with the Gas Light and Coke Company promoted a Bill, which became an Act, applying the system of price according to candle-power to the districts in which it was interested outside the City of London. In the following year, the South Metropolitan Company applied the system, by Act, to their district; the maximum being fixed at 3s. 9d., with 14-c.p. gas. The Imperial Company also applied the principle to their undertaking, and adopted the same figures; and gradually the whole of London came under the system recommended by Mr. Cardwell's Committee.

Another important matter was that in 1872 there was a serious coal famine. The Gas Light and Coke Company then took advantage of the power of revision laid down in the Cardwell recommendations, and were successful in getting the maximum price increased from 3s. 9d. to 4s. 4d.; while in 1874—the coal famine still proceeding, and the hardship becoming emphasized—they succeeded in getting the price raised to 5s. The Imperial Gas Company in the same year made a similar application, and obtained an increase from 3s. 9d. to 4s. 8d. for 14-c.p. gas. By this time the amalgamations recommended in the report had reduced the thirteen London companies to nine; but even this number was the cause of further discontent, owing to some of them having secured increased maximum prices while others had not. The result was that the Board of Trade became convinced that the system of revision was unsatisfactory and unworkable. There was also complaint at that time as to the allotment of capital to then existing shareholders at par; and it was at this stage that he arrived at the first suggestion of the sliding-scale.

A sliding-scale of a kind had been invented and applied at Sheffield in 1866, although he did not believe it had ever been applied in this form elsewhere. In West Ham also, a sliding-scale had been adopted in 1869. In 1874, the then Mr. Livesey advocated, in a paper before the British Association of Gas Managers, a sliding-scale which should slide both upwards and downwards. In 1875, three Bills were promoted in Parliament—one being by the City Corporation and the Metropolitan Board of Works, and the others by competing companies—viz., the Imperial Company and the Commercial Company. The first Bill was to regulate the two Companies. It proposed a sliding-scale with a slide one way only—viz., a reduction in dividend if the price were increased. These Bills were referred to a Committee presided over by Mr. Farrer; and a letter was written to the Committee by the Board of Trade which suggested a sliding-scale which worked both ways as being more effective in securing due care and economy than the system then in force. The letter also suggested the introduction of the auction clauses, which were a very important part of the sliding-scale system. The result was that the Bill promoted by the City Corporation and the Metropolitan Board of Works was rejected. The Chairman expressed strong views on the unfairness of a slide only one way, and the Commercial Company's Bill was passed with the new form of sliding-scale in it. This was the first Act to contain the double-acting sliding-scale. This system was described at that time as a reward for a low price and a fine for a high price; and it now seemed a little hard that, with due care and management, gas companies should be fined for circumstances over which they had no control, and which forced them to charge a high price.

In 1876, the Chartered Company—now included in the Gas Light and Coke Company—and the South Metropolitan Company both presented Bills which included the sliding-scale and auction clauses; and in 1877 the Standing Orders of the House of Lords, which required the auction clauses to be inserted in every Bill and made it competent for a Committee to insert the sliding-scale, made their appearance. From that time the sliding-scale was commonly used, and it be taken to have been a great success. It had brought the consumer and the producer into one common interest; and where co-partnership schemes had been adopted, it had brought the consumer, the producer, and the workman into one common interest, because the maintenance of a low price for gas was satisfactory for all three.

Notwithstanding that it had been a great success, there were cases in which attempts had been made to alter it. The first of which he was aware was in 1881, when the South Metropolitan Company came with a Bill for the erection of new gas-works at East Greenwich, and the Metropolitan Board of Works objected to the amount of capital, and asked for a revision of the sliding-scale. Their argument was that the standard price of 3s. 6d. had been fixed for the South Metropolitan Company *quâ* the South Metropolitan Company, but that as since then the Company had amalgamated with the Phœnix and Surrey Consumers' Companies the standard price ought to be altered, as there had been a complete change in the circumstances. It was admitted that if in the course of years circumstances so altered that the standard price did not bear the same relation to the dividend that it did when first sanctioned, there was a good case to come to Parliament for revision. It was for this very reason that he was now asking for a change to be made; the circumstances having altered, through no fault of the companies.

The next attempt to alter the sliding-scale was in the case of South Shields in 1886. There was another in the case of Plymouth in 1894, which failed; and another in 1896, in connection with the South Metropolitan Company. This Bill was for the conversion of capital;

and the London County Council, as successors of the Metropolitan Board of Works, asked for the standard price to be reduced. The Company argued that the mere conversion of capital conferred no benefit on the shareholders; and Parliament took this view, with the result that the attempt failed. In 1898, the Southend Gas Company applied to Parliament; and although he had not got the details, it was the fact that the standard price was reduced—the first instance in which it had been done. In 1899, the Lea Bridge Gas Company came to Parliament with a Bill for a substantial addition to their capital; and Lord Camperdown, when presiding over the House of Lords Committee who considered the Bill, took the view that as the additional capital should enable the Company to manufacture more cheaply, the standard price should be reduced.

Breaking off here, Counsel drew the attention of the Committee to the fact that in 1899 a very important Committee was set up by the House of Commons to inquire into the powers conferred by Parliament upon Metropolitan Gas Companies, and to report as to the manner in which these powers had been exercised. This Committee was presided over by Sir James Rankine. The appointment of the Committee was brought about in this way. For many reasons there was a substantial difference between the price of gas in various parts of London; and this led to dissatisfaction and agitation. The report of the Committee was of great value, because it suggested to Parliament that, in the view of the Committee, the time had come when some revision in the standard price should take place. Since then there had been substantial reductions in the standard prices in London. For instance, the Gas Light and Coke Company, who in 1899 had a standard price of 3s. 9d., now had 3s. 2d.; the South Metropolitan Company in the same period had dropped from 3s. 6d. to 3s. 1d.; and the Commercial Company from 3s. 9d. to 3s. 3d. There were also cases where reductions had been made in the Provinces.

Although he had referred to the period of the sliding-scale as the third period, it was not in itself an exclusive period, because the sliding-scale had not been adopted by, or applied to, all companies. There were still a number of companies, some of them in the list of those whom he represented, which worked under the maximum price system. There were also local authorities working on the same system.

Mr. HONORATUS LLOYD, continuing his opening after lunch, said he should have mentioned that in 1873 the Newcastle-on-Tyne and Gateshead Gas Company obtained an Act in which it was recited that, in consequence of the increase in the price of materials and labour, it was expedient that the maximum charges for gas laid down in an Act obtained by the Company in 1864 should temporarily be increased.

The CHAIRMAN asked if there was any limitation of period for the increase.

Mr. HONORATUS LLOYD replied that it was four years. Coming to the details of the particular case which he desired to lay before the Committee, Counsel said he could sum it up as the hardships under which gas undertakers were suffering through circumstances beyond their control, and not brought about by lack of care in management on their part. There was first the price of coal; and he admitted at once that the reply to his argument on the increased cost of coal was that when the sliding-scale was fixed nobody ever thought the price of coal would remain stationary. Nevertheless, nobody ever dreamed there would be the abnormal conditions that now existed. Moreover, it was not only the price of coal which affected the gas companies, but the quality had depreciated badly. The coal that was now being delivered had not been cleaned and attended to as it used to be, owing to lack of labour; and a large percentage of the so-called coal that was delivered had to be got rid of. This, in the first place, was bought and paid for as coal, and, in the second place, it cost money to have it carted away. Then there was what he almost called the interference of the Government; but he did not wish to use an expression of that sort, because he was not complaining.

The CHAIRMAN: Let us say intervention.

Mr. HONORATUS LLOYD said the companies all recognized that what had been done was for the nation's good, and they were willing to continue to do their best to assist the Government. But he could not help calling attention to the effect of this Government intervention upon the working of the gas undertakings. Many companies which formerly obtained coal from particular collieries had to abandon their contracts owing to the difficulties of transport; and gas-works generally were now limited as to the areas from which they could draw their coal supplies. Thus one company might get a better coal than before, but many companies were now called upon to make gas from coal which he would not say was absolutely unsuitable but which was much less suitable than the coal they were formerly having. Things were bad enough in 1917; but they were now much worse. In October, 1917, an extra 2s. 6d. per ton was granted to the coal owners; but, owing to the fact that the order was made in October, 1917, the extra cost only appeared in the accounts for that year for one quarter. This would be much more seriously reflected in the accounts for 1918. Then the cost of carriage had increased very greatly, as also had the cost of oil—the price having gone up from 2½d. to 1s. 2½d. per gallon—although again this latter affected some companies more than others. The Committee would be fully aware that labour charges had gone up with a bound, which again would be reflected more in the 1918 accounts than 1917. The cost of repairs and materials showed huge increases, and seriously affected the cost of manufacture.

It would be said that in considering gas-works both sides of the accounts must be looked at, and the bye-products taken into account. Speaking generally, it was often said that the revenue from the sale of bye-products followed to some extent sympathetically the price of coal, and that the increased price of coal should bring increased revenue from bye-products. At present, however, many of the bye-products were required for high explosive purposes, many were limited in markets, and some of them were limited in price. The result was that the bye-product account had not followed anything like sympathetically the rise in the price of coal. In addition, the companies now had the Lighting Restriction Order, which would restrict output and involve a great deal of labour in order to bring about the desired result. At the same time, the standing charges could not be cut down in anything like the same proportion; and they could only regard the immediate future as a very doleful one from the point of view of finance. The companies had suffered mainly in the reduction of dividends because, owing to the extra cost of manufacture, the charges had had to be raised and the dividends had automatically decreased. This was perfectly right and proper in normal circumstances. But the increased cost of manufacture was due to no fault of the companies; and he contended that it was a little unfair that the sliding-scale should still operate in the same old way without some modification. The injurious results which had been brought about on the lines which he had sketchily indicated had affected different companies in different ways according to their circumstances; and he would not attempt to give the effect upon individual undertakers. Of the 25 undertakings which he represented, 20 were sliding-scale companies and 5 were maximum-dividend companies; but he could not help feeling, from the knowledge which came to him, that had the effects of 1917 been as they were likely to be in 1918, the Committee would have been dealing with Bills from nearly every company in the country.

There was one distinguishing feature of the sliding-scale companies to which he ought to call attention. Under the Gas-Works Clauses Act the companies could pay back dividends; and it might be said that they were suffering no hardship whatever if they did this. This, however, meant continuing the present high prices of gas in the future; and it seemed a little hard in these days to suggest that this extra amount should be put upon the consumer in the future. At the same time, he reminded the Committee that some of these companies would, after the war, be in such a position that they could not go on at all. As an example, he would take the Southampton Company. The maximum price was charged in the last half year of 1916; but in 1917 the Company only paid 4 p.ct., as against 5 p.ct. in 1916, and this 4 p.ct. absorbed £1956 brought forward and £8067 from the reserve—in other words, the deficit on the working for 1917 was £10,023. The maximum price was 3s. 6d.

Mr. BAILEY remarked that this was not a deficit on the working of the undertaking, but merely a deficit on the dividends.

Mr. HONORATUS LLOYD said that in 1918 this deficit would be greater. One of the special difficulties in the case was that the coal was entirely seaborne and still was, as, owing to military and other traffic, there was no room on the railways for coal. They had to pay £3 7s. 6d. per ton and had great difficulty in getting it at all.

In answer to the CHAIRMAN, Counsel said the present reserve fund at Southampton was £38,336, renewals *nil*, insurance *nil*, carry forward *nil*. In June, 1914, the reserve was £53,362, and a carry forward of £2767; making £56,129. Another illustration, which happened to be the smallest among the promoters, was the Ogmore Company, who had a Provisional Order before the Board of Trade. In this, the maximum price was to be raised from 4s. 6d. to 6s. 6d. during the war and for two years after. In 1914, the Company, as a maximum-price Company, were charging the maximum price, and were authorized to pay dividends of 10 p.ct. and 7 p.ct. on two classes of shares, but they paid only 5 p.ct. and 3½ p.ct. Since 1915, they had not been able to pay any dividend at all; and now they were not able to pay the preference dividend. He did not put these forward as fair illustrations of all the companies, but as showing that there was some case for relief, and not necessarily that it applied to any particular company.

With regard to the local authorities owning gas undertakings, he understood there were many that had reached the maximum price; and if they were to go on without relief, it meant that the loss on the undertakings would have to be met partly by the consumers of gas and partly by the ratepayers. It was, moreover, a matter of interest to find that the local authorities could be divided into two classes, and that when they were owners of gas-works they were with the companies in this matter, and when they were not they were in a body on the other side. It seemed to show that they appreciated the hardship, and that when it touched them they desired to participate in the benefits that might be obtained.

Summing up the effect of the increased cost, Counsel said that in many cases, notwithstanding increases in charges to the consumer, the revenue had not covered the cost of the gas into the holders. It might fairly be asked what were the resources of the companies; and he proposed to put before the Committee details in this respect. The proposals of the companies to meet the position could be put into two forms—either that the standard price should be raised temporarily, or that an alteration should be made with respect to the slide so that 20 p.ct., or one-fifth only, of the statutory reduction should apply. An illustration of the second proposition was that supposing that the slide in the dividend was 2s. 6d. in respect of every penny in price, then the 2s. 6d. would be 6d. He was told that this would not involve an increase in the price of gas of more than 1d. or 1½d. per 1000 c.ft. The remedy in the case of the maximum dividend was much simpler, being merely an increase in the maximum price. The local authorities among whom inquiries had been made suggested two alternatives—viz., an increase in the maximum price or the suspension of contributions to the sinking fund.

The CHAIRMAN: Am I correct in taking it that, supposing the sliding-scale provides for a decrease of dividend of 2s. 6d. against every increase of 1d. in price, you propose that the decrease of dividend shall be 6d. for 1d.?

Mr. HONORATUS LLOYD said that was so, and applying it to the actual price it would work out in this way. Supposing the authorized dividend was paid in 1914 and amounted to £4, and the dividend actually paid in 1918 was £3, the companies asked that 80 p.ct. of the difference of £1 should be allowed them.

One of the main objections to the proposal was that the existing sliding-scale had been regarded as a bargain, and that the companies had themselves resisted any attempt to alter it. It was quite true that the companies had consistently deprecated any attempt to alter the sliding-scale unless there was some other alteration made which was a fair *quid pro quo—i.e.*, unless there was something done in altering the nature of the commodity which they produced, or something happened which was entirely apart from their management. He had already quoted instances. In addition, there was the case of the South

Metropolitan Company's Bill in 1900, in which the illuminating power was reduced from 16 to 15 c.p. and the standard price lowered from 3s. 3d. to 3s. 2d. In the same Act it was arranged that the candle power should be further reduced from 15 to 14 c.p. as from 1905, and the standard price reduced to 3s. 1d.; the view being taken that as the illuminating power was being lowered it was a fair thing to reduce the standard price. In 1902, the Commercial Gas Company were before Parliament for the conversion of their capital and the reduction of candle power, and the standard price was reduced from 3s. 9d. to 3s. 3d.—again because it was held that the reduction of the candle power would help to reduce the cost of manufacture. In the same year the West Ham Company had their candle power reduced from 16 to 14 c.p., and their standard price from 3s. to 2s. 11d.; showing that where the nature of the article had altered and the cost of production decreased, there should be a decrease in the standard price. For a similar reason the Gas Light and Coke Company had their standard price reduced in 1903 from 2s. 9d. to 2s. 4d.; and the same year the Faversham Gas Company had their candle power reduced from 15 to 14 c.p., and the standard price from 4s. to 3s. 11d.

The CHAIRMAN said the fact in the minds of the Committee was whether the promoters could justify, by the conditions and the evidence, reasons for making a variation. If they could so warrant it in this way, the Committee would not hesitate to recommend an alteration being made.

Mr. HONORATUS LLOYD said his object at the moment was to meet the suggestion that the companies had consistently opposed any alteration in the sliding-scale. There were many instances in which companies had voluntarily themselves reduced it in Bills, and there were others in which Parliament had said that when there was an alteration such as he had described, the standard price should be reduced. The same thing happened in connection with the Standard Burner Bill, when the local authorities asked for a change which Parliament refused on the ground that no alteration was being made that would give the companies any benefit. Then it was said that the companies were merely suffering from hardship which was common to all. But this was not so. Gas companies were not commercial companies in the ordinary sense. They had a statutory monopoly subject to regulation. They could not stop their businesses as they pleased; they were under statutory obligation to supply. Then it was said, quite truly, that the quality of the gas was inferior to what it was before the war. No gas manufacturer would deny this; but it was not the fault of the companies. It was brought about by the inferior coal and by the ingredients that had to be extracted from the coal for the nation's welfare for high explosives. The gas companies recognized the long suffering of the public in this matter, and had been grateful for the way in which the public had put up with gas which they knew perfectly well the companies were obliged to supply. Another objection was that the shareholders were receiving rates which compared reasonably with other ventures. The fact was that in some cases they were receiving rates which would not attract capital at all, and so far from being able to sell at a premium—which was usual before the war—it would be impossible to sell the shares at a large discount. There seemed to run through the petitions a sort of general feeling that gas companies were large capitalists who were profiteering at the expense of the consumer. There never was a more fatal mistake. In the first place, although many companies had some large shareholders, the gas industry was almost unique in the comparatively small amounts held by individual investors; while where co-partnership schemes were in force a considerable amount of capital was found by the workpeople, and to suggest that they were large capitalists profiteering was altogether unjustified.

MR. WILLIAM CASH'S EVIDENCE.

Mr. *William Cash* said he had had placed before him information collected by the National Gas Council, from which it was evident that the hardship began to be felt by the companies gradually In August last year, the National Gas Council made inquiries of companies and local authorities in order to gain information as to the position of the industry as a whole. This information now, however, was largely out of date, except as regards the promoting companies, as it was impossible to recircularize the several hundred undertakings which were originally communicated with.

The CHAIRMAN asked as to the constitution of the National Gas Council and the Gas Companies' Protection Association.

Witness said that a number of companies were members of both bodies.

Mr. *D. Milne Watson* explained that the National Gas Council was composed of representatives of the governing bodies of four other bodies —viz., the Institution of Gas Engineers, the British Commercial Gas Association, the Gas Companies' Protection Association, and the Society of British Gas Industries.

Mr. *Cash*, continuing his evidence, said that inquiries were made of 410 undertakings, and replies were received from more than half. The capital represented by the replies was £86,000,000. It was shown that undertakings in almost all cases were suffering from hardship owing to the increased cost due principally to the rise in the price of coal, oil, freight, and materials, and the very substantial increase in the cost of labour. In almost every case, also, the increases in costs had resulted in an increase of price to the consumer. As typical instances of the enormous increases that had taken place, he mentioned that in the case of the Newcastle and Gateshead Gas Company materials other than coal had increased during the war by 125 p.ct., and in the case of the South Metropolitan Company the wages bill had increased from £305,000 at the end of June, 1914, to £502,000 in December, 1917. The increase in the price not only resulted in a reduced dividend to the shareholder, but further affected him in that the capital value of the stock also fell. The conditions of the war further injuriously affected the gas undertakings, in that they were carrying larger stocks; and as prices were higher, the amount of working capital was increased. Stocks of residuals had been very heavy indeed. The rationing of solid fuel in London had held-up the sale of the London companies' coke, and on Dec. 31 these were exceptionally large. Then as regards tar, the Government were holding-up stocks in view of the needs of the Navy.

At the close of the day's proceedings,

Mr. PRITCHARD renewed his application to be heard; but the Chairman said he did not think it would be well to say anything for the time being.

Second Day.—Wednesday, May 1.

Mr. *Cash* continued his evidence in chief. After explaining to the Committee the difference between a maximum-price company and a sliding-scale company, as well as the operation of a neutral zone in connection with the latter—*i.e.*, those cases in which an increase of price is permissible under the Act, within a certain limit, without a decrease in dividend—he went into some details concerning the undertakings which had sent information to the National Gas Council. Up to August, 1917, ten companies had reached their maximum prices, and of these, four had promoted Bills. Eight other companies, which had not paid their maximum dividends, had been compelled to pay reduced dividends during the war. In many cases, although the maximum dividend had been paid, it had not been earned, but had been made up out of the reserve fund or the carry-forward; and this had the effect of weakening the financial position of the companies which did it, whether they were sliding-scale or maximum-price concerns, because investors could not be attracted. The capital accounts of the majority of companies were considerably overspent; and it would be necessary for them to raise capital in the near future. The present condition of affairs, however, would make it very difficult. In some cases there was overspent capital on works which were not completed; but in the one instance with which he was personally acquainted, this was not due to lack of capital, but to the difficulty of obtaining a permit for the steel for a holder. The case of the Garw and Ogmore Gas Company, of which details had been given by Mr. Honoratus Lloyd, was a special one, in which the hardship was so great that the Board of Trade had agreed to an increase of 2s. per 1000 c.ft. in the maximum price. Of the local authorities who had responded to the invitation of the National Gas Council for information, fifty said they were suffering from hardship, and about forty said they were of opinion that special means should be taken to alleviate the difficulty. Of these, the maximum price had been reached in twelve cases; but the majority of these local authorities were not large ones. Some owned undertakings which had been acquired comparatively recently from companies, and they had, of course, taken over the maximum price that existed when the companies worked the undertakings.

The CHAIRMAN asked, assuming a company were working at a loss, what means existed to compel them to continue to supply?

Mr. TALBOT, for the promoters, said that if a company were at the end of their resources, and could raise no further capital, there was no remedy.

The CHAIRMAN: It would be the destruction of the company?

Mr. TALBOT: Yes.

Witness then handed in a table [see pp. 232-3] showing the companies who are promoting the Bills, and giving details of their past and present position. The details were explained at considerable length. Speaking of the effect of the restricted coal supplies, special mention was made of Liverpool, where the Company had exceptionally favourable contracts which had to be abandoned. Now Lancashire coal had to be taken instead of South Yorkshire.

The CHAIRMAN remarked that this would not necessarily be a loss to Liverpool.

Witness said it would, because they did not get such a good coal, and oil had to be bought to make up the deficiency in quality.

Quoting the South Metropolitan Company as an instance of the effect of the war on dividends, witness pointed out how, in June, 1914, the Company were charging 2s. 2d. per 1000 c.ft., and paid a dividend of £5 9s. 4d. In the next year the price had to be increased to 2s. 4d., and the dividend fell to £5 4s. In the first half of 1915, the price was increased to 2s. 10d., and the dividend fell to £4 8s. It remained at this figure until December, 1916, when, owing to a decrease of 2d. in the price, it went up to £4 13s. 4d. In December, 1917, the dividend had dropped to £4 (the price being 3s. 1d.); and on the basis of the January, 1918, price of 3s. 7d., it would be £3 4s. Out of the twenty sliding-scale companies represented on the table, eight did not pay the standard dividend in December, 1917. Three of the maximum-dividend companies had not paid their maximum dividends; while the following six companies would be paying less than the maximum dividends this year: Commercial, Hastings, Liverpool, Portsea Island, Richmond, and South Metropolitan. Reverting to the cost of coal, witness said that in the case of the Gas Light and Coke Company, the increase since the beginning of the war was 97 p.ct.; South Metropolitan, 156 p.ct.; Brentford, 153 p.ct.; and Portsea Island, 143 p.ct. In the case of the Liverpool Company, they only had the sliding-scale in 1915 (it being passed in the session of 1914); so that they had not derived any benefit from it. As a matter of fact, Liverpool did not raise the price of gas until December, 1917, and then 3d. was added. Hitherto all the benefit of economical working at Liverpool had gone to the consumer. The return on the Liverpool capital in 1918 was only £4 5s. on the 5 p.ct. stock. Dublin was a peculiar case, and must not be judged actually on the figures. The position was that in 1914 he was called in to make an examination of the accounts. There was considerable dissatisfaction on the part of the shareholders with the management, and a new Board was constituted. In the last half year of the old Board (December, 1913), the dividend was only 2¼ p.ct. The new Board in 1914 said they would clear up matters which ought to have been put right before, and not pay any dividend for that half year; so that in June, 1914, the shareholders were getting nothing, compared with £4 7s. 6d. in 1913. The fair comparison for Dublin was between December, 1914, and December, 1915. The case of Southampton had already been referred to by Mr. Honoratus Lloyd. It was only right, however, to mention that the price of £2 7s. 6d. per ton of coal referred to was not the general price; but it had been paid for one or two cargoes. All the coal

still came by water to Southampton, owing to the congestion on the railways.

Mr. Honoratus Lloyd said that when he mentioned the price of coal at Southampton he was under the impression that the figure given was the general price.

Witness then referred to coal difficulties at Bournemouth, where a great deal of Somersetshire coal now had to be used. The coal which still came from the North now cost 24s. 6d. per ton for freight, as against 3s. 9d. before the war. Somersetshire coal was nothing like so clean as Durham coal; and this fact involved extra cost in labour to handle it. Then the price of oil had increased from 3d. per gallon to 11½d., and it was now practically impossible to buy oil. Unsold coke was another important item affecting the position of the companies. The Gas Light and Coke Company had 61,000 tons in stock, and 104,000 tons of breeze. The latter compared with 17,000 tons in 1914; but the coke was about the same. The position had altered very much for the worse since the beginning of the year. The 2s. 6d. increase in the price of coal only came into the last quarter of 1917; but it would appear in the accounts for the whole of 1918. In Wales, a further 2s. 6d., making 5s., had been added to the cost of coal; and it so happened that four out of the five maximum-price companies which were promoting Bills were in Wales There had also been a considerable increase in the rate of pay, and all men over 18 years of age had had their war bonus made up to 20s., with a further 12½ p.ct. This increase meant 2½d. on the price of gas. The recent order restricting the amount of gas in the Southern part of England would add 3d. to the cost of manufacture, because it was impossible to reduce standing charges or staff—indeed, a great deal more work would have to be done in order to answer inquiries as to individual consumption, &c.

Commenting on the position as to reserve funds, witness said that in many cases these were not readily available, and a great majority of companies owed their bankers considerable sums. The South Metropolitan Company had a reserve fund of £250,000, mostly invested; but they owed their bankers £500,000. The Gas Light and Coke Company had substantial sums, both in reserve and as carry forward, and, as a matter of policy, had realized their investments in order to discharge their liability to the bankers. Yet they owed their bankers £100,000. Of the 28 Bills deposited, 13 proposed to apply, as a temporary measure, for a period of two years or more after the termination of the war, or such longer period as might be allowed, the relief which Mr. Honoratus Lloyd had described as the 80 p.ct. and the 20 p.ct. Two companies suggested that the slide should be amended by substituting 6d. for 2s. 6d. in respect of each penny up or down in the price of gas; two others—the South Metropolitan and Maidenhead Companies—asked that the standard price should be increased by 6d.; and two others—the South Suburban and Cannock Companies—asked that the standard price should be increased by 9d. Liverpool asked for the neutral zone to be increased by a further shilling. The effect of these changes on the price of gas would be an increase of 1½d. in the case of the South Suburban Company, for the South Metropolitan Company 1d., 1½d. at Brentford, and 1·6d. at Portsea Island. In his opinion, it must be some years, if ever, before pre-war conditions returned; and he based his case for relief on the artificial circumstances created by the war, which were entirely beyond the control of the companies. It had been said that the gas shareholder still got a fair return on his stock; but in many cases considerable sums had been paid by way of premium. As an example, he himself, some years ago, paid £305 for £100 of Gas Light and Coke Company stock; and last year his dividend was only £2 8s., while the stock itself was worth about 62. The yield to the investor of capital subscribed by auction was very low indeed. On the whole of the Plymouth Company's capital issued since 1892 it was less than 3 p.ct.; in the case of Portsea Island, it was 3 p.ct.; in the case of Cardiff, 4¼ p.ct.; and on the whole of the capital issued by the South Metropolitan Company since 1881, it was only 3·27 p.ct. Finally, witness mentioned the smallness of the individual holdings in gas companies. In no company included in the list of promoters was the average holding over £1000; and except Newcastle, which was £700, all the rest were £600 or under.

Witness Cross-Examined.

Mr. Freeman, in opening his cross-examination, explained that he appeared for the London County Council, the Association of Municipal Corporations, and the Urban District Councils' Association, as representing local authorities not owning gas-works. He put it to witness that, up to the outbreak of the war, the sliding-scale had enabled the companies to pay very satisfactory dividends—considerably in excess of 10 p.ct. if reckoned on the original capital subscribed. But Mr. Cash urged that the premiums could not be left out of account when computing the dividends that had been earned. Between 1875 and the outbreak of war, Counsel put it that £7,711,000 had been earned in excess of the standard.

Witness said he had no means of checking the figure; but if it were accurate, then the consumers must have received a benefit equivalent to £40,000,000.

Mr. Freeman: What you are asking the Committee to do is to relieve you of the major part of your share of the extra cost which you bear now under the sliding-scale, and put it on the consumer.

Witness agreed.

Mr. Freeman remarked that this was rather a curious way of carrying out a partnership agreement, such as was the case under the sliding-scale.

Witness said this was subject to the observation that the partnership was arranged under conditions which it was never contemplated would change as they had done.

A number of questions were then put as to the price of coal, with the object of showing that coal, at the time the sliding-scale was introduced, was dearer than it is to-day. In 1871, it was put that the net cost of coal to the Gas Light and Coke Company was 15·45d. per 1000 c.ft. of gas made, 16·48d. in 1872, 19·14d. in 1873, 21·57d. in 1874, and only 12·48d. in 1918. Now the companies were proposing to take 80 p.ct of their reduction of dividend out of the consumer, and the consumer got no equivalent whatever. Meantime, not only had consumers to pay this extra cost, but the gas, when they got it, was of very little use.

Witness differed with this last remark, and said that he was able to manage quite well with London gas. If the gas had been of a better quality, the price would have been higher still.

Mr. Freeman pressed witness as to whether it was fair and equitable that one of the partners should be asked to pay this 80 p.ct.

Witness thought it fair, for the reason that the sliding-scale was arranged having regard to the then existing circumstances, which had changed very much. The companies were not to blame.

Mr. Freeman said the consumers were not to blame either. Why, if neither partner was to blame, should the whole of the relief be given to one and not to the other?

Witness: I cannot carry it any further.

A series of questions were then put with regard to reserve and special purposes funds; the suggestion being that the companies could make up the deficiency in drawing upon these. Witness gave the figures for a number of companies, and pointed out that, notwithstanding the existence of these funds, in many cases the companies owed the bankers large sums.

Mr. Freeman replied that the financial position of the companies would not be made worse by drawing on these funds, as the Directors had distributed the earnings in past years instead of creating larger reserves.

In the course of further questions, witness said that, although he had no personal reasons for believing that the price of coal would be increased, he understood that it was in contemplation. He did not think the restrictions on the use of gas would lead to the stiffening of the price of coke. Householders would have to cut down both ways.

Mr. Freeman, on the general question, put it that everybody in business was suffering from the effects of the war, some more and some less, and why was it that gas companies were specially selected for relief, and other people were left to bear the burden?

Witness replied, first, because there was no obligation on other people to do business at all; secondly, because theirs was a free market; and thirdly, because gas companies were tied down in the matter of price. It was true that gas companies had a monopoly; but it was a regulated monopoly—in fact, it was not a monopoly, because of the competition of electric light, producer gas, and oil.

Mr. Freeman said that if the companies liked to put up with reduced dividends, they could always continue to supply. Everybody had to put up with reduced dividends now. He asked how the proposal now made inured in any way to the public interest?

Witness said it would certainly affect the stability of the companies for carrying on a public utility service. It would have a material effect on the financial position when new capital was raised, as it must be hereafter, because, if the dividends were cut down, new capital could not be raised on the same terms as before, and this would affect the price.

Mr. Freeman said that affected the consumer who did not mind running the risk. The proposal did not benefit the public.

Referring to the 80 p.ct. and 20 p.ct. proposal, Counsel asked how this was to be applied uniformly, as Mr. Honoratus Lloyd had said that the conditions differed, and no two companies could be dealt with exactly alike?

Witness agreed there was a difficulty there. Finally, he said that unless some relief was given to public utility companies, they must necessarily be hampered. They were suffering at present and must necessarily suffer still more, and this would inevitably have a disadvantageous effect on the public. There was no possibility of capital being raised on anything like economical terms unless relief was granted.

Third Day.—Thursday, May 2.

Evidence of Mr. D. Milne Watson.

Mr. *D. Milne Watson*, the Chairman of the Executive Committee of the National Gas Council and Managing-Director of the Gas Light and Coke Company, said that a meeting was held in August last year of representatives of company and municipal gas undertakings, at which it was agreed that a serious state of affairs had arisen in regard to coal and labour, and it was arranged that steps should be taken forthwith to try to obtain some relief. As a consequence, a certain number of companies deposited Bills; but sufficient time was not available for many others to do so. Giving details of the Gas Light and Coke Company, he said that the sliding-scale was first adopted in 1875, when the standard price was 3s. 9d., with a 10 p.ct. dividend. In 1904, it was changed to 3s. 4d., and in 1909 to 3s. 2d., for 14 c.p. gas; and the capital was converted to 4 p.ct. Speaking of the net cost of coal, which Mr. Freeman had said on the previous day was more in 1875 and onwards than now, witness said this was not so. It was only 13·11d. in 1875, when the price per ton was 19s. 5·69d. In 1876, it was 16s. 2·27d. per ton, and in 1877 it was still lower. The price continued to decrease until it reached 14s. 1d. delivered in London; whereas last year the price was 28s. 3d. per ton, and in the current year a further 2s. 6d. would have to be added to this figure. Seaham coal, which cost 12s. 5d. in 1876, was 34s. 6d. now. Relating the early history, which was gone into so fully by Mr. Honoratus Lloyd, witness called special attention to the report of Sir James Rankine's Committee of 1898, in the following respects. The Committee recommended a reduction in the standard price, which, in the case of the Gas Light and Coke Company, was 3s. 9d., on the ground that gas cost less to manufacture then than when the standard was fixed, and because capital could be obtained at a lower rate than formerly. The Committee also said that, as conditions were liable to fluctuation, it was within the power of Parliament to revise the sliding-scale if it were thought just and necessary to do so. After this report, several reductions in the standard price of the various gas companies in London were made, on the ground that some change had taken place which reduced the cost of manufacture. But now a state of affairs had been reached in which the conditions had been varied which made the cost of manufacture very much more.

In 1914, when the war broke out, the gas industry had never been in a more prosperous condition. It had made very great strides, both from the point of view of the number of consumers and the number and variety of uses of gas. In that year the proportionate make of gas in England, notwithstanding its smaller population, compared with Germany, was double. The prosperity of the industry had been largely due to the sliding-scale and the auction clauses, which had attracted capital on good terms. Since 1914, however, the industry had been extremely adversely affected by a number of causes, which came under five general headings—viz., (1) Coal, (2) labour, (3) materials and maintenance and repairs, (4) coal freights, (5) oil and oil freights. The first three causes affected all companies; but coal freights and oil and oil freights affected different companies differently, according to their circumstances. Attention was called to the successive stages in the increase in the price of coal, so far as the Government were concerned—first, by the 4s. increase under the Coal Price (Limitation) Act of 1915, then the extra 2s. 6d. in South Wales and Monmouthshire (making 6s. 6d. in these districts), and the subsequent 2s. 6d. all over the country in 1917. A special grievance of those companies who owned ships was that they were in the habit of buying bunker coal at the same rate as gas coal; but when the Government took over the control of the mines, they put bunker coal on to a new basis, which seriously affected those companies who brought their coal by sea. It was hard on the industry also that the last 2s. 6d. increase imposed by the Government should have been made in October, 1917, after the September meter readings were taken, because the companies could not recover any of it from the consumers during the three heavy months of the year. Moreover, the increase was made retrospective to Sept. 17, and also applied to arrears of orders; so that those coal-owners who had not kept time with their deliveries reaped the benefit of the extra 2s. 6d. This was a severe blow for the gas industry, which incurred an expense of between £600,000 and £700,000 for the last three months of 1917. In addition to the increase of price, there had been a very great deterioration in the quality of the coal, the ash content in which had increased considerably, as the results of tests in 1917 and 1918 showed. The figures of a large number of tests indicated that the proportion of ash varied between 15 and 30 p.ct., whereas the normal figure was between 5 and 6 p.ct. This ash had to be paid for, it involved labour and wagon-room, and spoiled the working results, because when such coal was carbonized the result of the working following was exceedingly bad. It was impossible to get the heats up; and even if good coal was put in the retorts, following a charge of bad coal, a poor yield resulted, because there was not enough heat in the coke to burn the coal properly in the next charge.

The cost of labour had also very largely increased under direct Government orders; and the total advance, including the 12½ p.ct., had been 26s. per week per man. As this had to be taken into account in connection with overtime, the actual advance was more. The effect of this was an increase in the wages bill of the Gas Light and Coke Company of £350,000 a year. The wages bill of the Company in 1914 was £1,013,000; but he doubted whether it would be less than £1,900,000 this year. This would represent 9d. per 1000 c.ft. The 12½ p.ct. represented 3d. per 1000 c.ft. The Company employed 1500 women, who had a bonus of 8s. 6d., which was shortly to be increased, as the 12½ p.ct. award did not apply to them. The women were paid at the same rate as the men having regard to the amount of work they did. It was found that three women did the work of two men; and the pay was divided more or less in this way. The present employees numbered 10,000 and 11,000 men and 1500 women, exclusive of staff. Of the original staff 4500 men had joined the colours.

In regard to the increased cost of materials, the following figures were given: Fire-bricks, 118 p.ct.; timber, 224 p.ct.; coke sacks, 2s. 11d. each pre-war, now 11s.; lubricating oil, 293 p.ct.; burners, 100 p.ct.; steel, 109 p.ct.; stock bricks, 110 p.ct.; matching timber, 323 p.ct.; shovels, 233 p.ct.; horses' fodder, 300 p.ct. An average figure of the increased cost of materials generally was 100 p.ct. Coal freights had gone up in an extraordinary degree. The rate from Newcastle to London by water had increased from 2s. 9d. to 21s., including insurance. Similarly, oil from America for the purpose of gas making had gone up from 2¼d. per gallon, delivered in tanks, to 1s. 2¾d.; while a neighbouring company of which he knew something, had paid 1s. 5¼d. under their last contract. As in the case of oil there were no residuals to speak of, the whole of the increased cost went on to manufacturing charges. The Gas Light and Coke Company used 13 million gallons of oil per annum, apart from lubricating oil.

As to residuals, the gas industry had done all it could during the war to meet national necessities. Lord Moulton, the head of the Explosives Department of the Ministry of Munitions, had paid a very great tribute to the gas undertakings of the country for what they had done, and went to the length of saying that he did not see how we could have carried on the war during the first year if it had not been for the fortunate circumstance that we had so many large and well-equipped gas-works which gave us an initial advantage which was exceedingly valuable, because it was from the gas-works alone at that stage from which a great many of the materials for the manufacture of munitions of war came. At one time, the Gas Light and Coke Company supplied one-fourteenth of the material for the high explosives that we made in this country. It was this which had lowered the calorific value of the gas. The return from residuals had been erroneously assumed to be large; but the fact was that the prices had been limited and controlled by the Government. The prices of toluol and benzol were fixed, and sulphate of ammonia had been fixed at a comparatively speaking low figure compared with the world figure, which was £40 per ton. If the gas companies could get that, it would have a very important effect upon their balance-sheets. The present price was £15 per ton, against a pre-war price of £12. Thus, generally speaking, the price of residuals had not been allowed to increase as much as the price of coal and oil. In 1914, the gross cost of coal and oil in the case of the Gas Light and Coke Company was 15·46d., and residuals brought in 8·49d.—bringing the net cost down to 7d. In 1917, before the full effect of the additional 2s. 6d. increase in price and of the extra cost of labour was felt, the gross cost of coal and oil was 29·38d., and residuals brought in 16·89d.; leaving the net cost at about 12·5d.—a difference of 5½d. since 1914. The Gas Light and Coke Company had supplied well over a million gallons of benzol and four million gallons of creosote to the Government during 1917. There was bound to be a prejudicial effect on the companies of the Lighting, Heating, and Power Order; but it was very difficult to estimate what it would be. It was, however, well known to business men that the last 20 or 30 p.ct. of business was the most profitable, as the standing charges could not be reduced, and remained practically the same for a small as for a large output.

The Order meant that the most profitable part of the business would have to be cut off, especially as the restrictions were upon coal gas, from which the residuals were obtained. As a rough estimate, the Order would affect the revenue of the promoting companies to the extent of nearly £500,000 a year. Government interference with the working and management of gas undertakings in the form in which it now existed was never contemplated when the sliding-scale was fixed. A gas undertaking was in a very different position to an ordinary trader, as it could not give up the unprofitable part of its business, as could an ordinary trader. The public had the right to demand a supply of gas, and it was in the anomalous position that, whenever it put up the price in order to meet an increase in working expenses, it had to sacrifice some part of its dividend; and this became a very serious matter at a time like the present. Dividends had already gone down, and would continue to do so unless some relief was given. In order to meet dividends, the Gas Light and Coke Company had had to draw on their reserve and other funds to the extent of £1,000,000 during the war. This had a serious effect upon the raising of capital, which he contended was a factor of public importance, as it inevitably affected the price of gas if capital could not be raised on reasonable terms. Consumers had had cheap gas in the past because capital had been raised cheaply. At a time when the Government were recommending that great new industrial schemes should be inaugurated—especially with regard to the carbonization of all coal for power purposes, in order to recover the bye-products—it would be a great pity, from the nation's point of view, to undermine the confidence of the public in the gas industry. After the war, there would be need to issue a considerable amount of new capital in the gas industry to construct works which ought to have been carried out during the war; and unless something was done, the companies would not be in the position to pay labour adequately after the war.

The Gas Light and Coke Company had a co-partnership scheme which was started in 1909, and now consisted of 8000 employees, who had invested £173,760 in the Company. The reduction in the value of this stock during the war amounted to £60,000; and it would have a serious effect upon these investors to allow this drop to continue. Further, the ordinary stock was held by a large number of small investors; there being 29,700 shareholders, of whom 11,500 held £100 and less. If Parliament in its wisdom considered that contracts should be interfered with under the Courts Emergency Powers Act, how much more should relief be granted in the circumstances of the sliding-scale? It was often overlooked that in the sliding-scale there was a third party—viz., the contractor—who could come in and upset the arrangement between the other two. He drew attention to the fact that under the New South Wales Act of 1912, the sliding-scale there could be revised if an increase of wages affected the cost of manufacture. This Act had been amended since the war, and was made to apply to anything which affected the cost of manufacture.

The reason why the calorific power of gas had not been so good during the war was due to several causes. First, there was the enormous increase in the demand for gas owing to the establishment of munition works, and also owing to the fact that the Government for a long time urged the public to use gas rather than raw coal, so that a large amount of residuals for munition purposes might be obtained. While this increase had gone on, it had been more difficult to get new plant. The winter before last, the Gas Light and Coke Company ordered new plant for the purpose of increasing the output by 13,000,000 c.ft. per day; but instead of getting this plant, they had only been able to obtain sufficient plant to increase the output by 4 to 5 million cubic feet per day. The Company had all the retorts installed; but they could not get the stoking machinery for want of steel, because the Government would not give priority. The result was that the Company were no better off last winter than they were the winter before, notwithstanding the considerable increase in the demand. Therefore, there had been very great difficulty in keeping up the supply of gas. There was also the fact that the coal was inferior; and the limitation of the oil supply made it difficult to enrich by means of oil. Thus the pressure dropped from time to time as well as the calorific value. The consumers had taken this very well—knowing, of course, that the Companies could not help themselves. The variation in calorific value was shown by the following figures taken by the local authorities: June, 1914, 540 B.Th.U.; December, 1914, 534; June, 1915, 524; December, 1915, 518; June, 1916, 507; December, 1916, 496; June, 1917, 501; December, 1917, 504. It would be seen that there was a tendency to recover. The standard to which they were supposed to work was 540 B.Th.U., with a margin which brought it down to 499·5 as the actual working standard.

In conclusion, witness drew attention to the fact that the return upon the shares of the Gas Light and Coke Company had been on the average a very small one. Whereas when the price was 2s. 6d., the dividend represented 7d. per 1000 c.ft., to-day, with the price at 3s. 10d., the amount was only 4d. He did not ask that the Company should be placed in as good a position as they were before the war, as were the railway companies—it was only asked that the slide should be reduced by one-fifth of what it was now.

CROSS-EXAMINATION OF MR. MILNE WATSON.

Mr. CLODE began his cross-examination by suggesting that the Gas Light and Coke Company had handed on to the consumer the whole of the extra costs of manufacture caused by the war. As demonstrating this, he went through the figures of costs. In 1913, the net coal was 4·45d., works charges 6·87d., and distribution charges 6·37d. —making a total of 18·35d., excluding coal; including the coal, the total costs were 22·8d. In 1917, the corresponding figures were: Net coal 12·49d., works charges 9·23d., and distribution charges 6·41d.—a

total of 20·86d. excluding coal, and 33·35d. including coal. This represented an increase of 10·55d. By the end of 1917, the price had been increased from 2s. 6d. to 3s. 4d., or 10d., leaving ½d. over.

Witness agreed that this was so.

Mr. CLODE continued his point as follows: One penny per 1000 c.ft. on the Company's output represented £118,220; so that the ½d. which remained over represented £59,110. It was only to this extent that the profits of the Company had decreased between 1913 and 1917; and the reserve and special purposes funds were ample to meet this difference if the Company had desired to do so.

Witness said the point was that due care and management could not have prevented this loss, and the Company would undoubtedly have been content to draw upon the funds in question in the way suggested had there been a chance of the war coming to a speedy conclusion.

Mr. CLODE said the Company were only £59,110 out, and yet the reserve fund represented £341,000, and the carry-forward in December, 1917, was £251,000. Further than this, the Company had written-off during the year capital expenditure out of revenue to the extent of £393,527.

Witness replied that depreciation on meters and stoves represented £142,000, which was the proper and prudent thing to do. The remainder represented money received for lost ships, and was disposed of in the way mentioned. It was absolutely essential to depreciate a property like that of a company; and if stoves especially—which were always changing—were not written-off, the Company might find themselves in a serious position after the war. With regard to the realization of investments to the extent of £168,000 in 1917, the Company either had to do this or write them down. They continued to lose money by holding them. He was now glad they had been sold, because they had gone down since by £95,000. The sale was also carried out with the object of relieving the position at the bank.

Mr. CLODE, continuing the outline of the case for the London County Council against the proposals of the Bills, said that the Gas Light and Coke Company did not realize the full benefit of the advance in 1917, and therefore had something in hand on that account, which he put at 1½d. [Mr. Milne Watson thought 1d., though it was difficult to name any figure], and in 1918 a further 6d. had been added to the price to the consumer; making a total of 7½d. in hand over what had already been obtained by way of increased price to cover the anticipated worse portion in 1918. A price of 3s. 10d. would reduce the pre-war dividend of £5 1s. 4d. to £2 18s. 8d. in 1918; but under the proposition as laid before Parliament, the Company would be able to pay £4 13s. 4d., compared with the standard of £4. If the price was raised to 3s. 11d., the dividend would be £4 12s. 10d.; at 4s., it would be £4 12s. 4d.; and at 4s. 1d., it would be £4 11s.

Witness agreed with these calculations, except that the redemption fund of £20,000 had to be taken into account, which would slightly reduce the dividend below the figures mentioned. For instance, the £4 13s. 4d. given for the 3s. 10d. price would be £4 10s. 8d.

Mr. CLODE asked the justification for such a proposition.

Witness replied that nothing had happened in the management of the Company since 1914 which made it fair that they should be penalized by a reduction of the dividend which was being paid before the war, although it was not asked that the whole difference between the present and pre-war dividends should be made up. Gas companies were doing as much national work as the railway companies, whose 1914 dividends were being maintained by the Government. What had happened to increase the costs of production had been entirely out of the gas companies' control. He agreed that, on the make of 1917, the balance of 7½d. already referred to would bring an additional revenue of £910,000 in 1918. But it was impossible to say what would be the make in 1918; and it was conceivable that there would be a reduction of the Gas Light and Coke Company's revenue of £150,000 on account of the rationing.

Mr. CLODE next called attention to the fact that the Company had paid dividends in 1913 and 1914 in excess of the standard; leaving heavy deficits in those years. Again, in 1916, a dividend in excess of the standard was paid, and the year closed with a deficit of £95,106. [Mr. Milne Watson said the price of gas was too low.] The Company were not compelled to pay a dividend in excess of the standard; and if they had not done so, they would have had a substantial sum to meet contingencies arising out of the war. Dealing with the make of gas, he pointed out that more gas was being made per ton of coal in 1917 than in 1914—the figures being 11,971 c.ft. and 10,211 c.ft. respectively. In the meantime, the gas had considerably deteriorated; the percentages of inerts being 5 p.ct. in 1914 and 20 p.ct. in 1917—the maximum in 1917 being 30·9 p.ct.

Witness contended that the quantity of inerts was now being reduced; but it was due to the fact that the coal as it now came to the works had not been cleaned as it used to be.

Answering questions as to the number of occasions upon which the calorific value of the gas had been below the penalty figure [Mr. Clode said the Company had been liable on 517 occasions in 1917], witness said he was surprised it was not more, considering the difficulties that had to be contended with.

Mr. CLODE: But the South Metropolitan Company have been liable on only 13 occasions?

Witness said that in fairness to the Gas Light and Coke Company it should be said that they washed their gas for benzol to a greater extent, and the gas suffered a distinct depreciation on this account. It had been said that the Company were carrying the process of washing by oil further than was necessary for munition purposes. He disagreed with this entirely, because the Government urged them to do so. At a recent meeting, the Coal Controller, after cutting down the quantity of coal, said there must be no relaxation of washing the gas. The Gas Light and Coke Company washed their gas with oil in a much more thorough manner than some others. It was well-known that oil-washing had not been adopted entirely by some companies.

Asked as to the public expediency of putting more money into the pockets of the shareholders, witness retorted that it might please some people if there were no dividends at all; but as a business proposition, this would prevent the companies raising any capital at all. It was true that the Gas Light and Coke Company were not contemplating making an issue of new capital; but whether they did so entirely depended on what occurred after the war. The pre-war dividend of £5 1s. 4d. was a very low rate; but under the scheme the Company would get less. It was important to the public that public-utility schemes should be on a sound financial basis.

In re-examination, witness said he would rather not have to wash the gas in the way it was now done; it was no advantage to the Company.

Answering Mr. J. ALLEN BAKER (a Member of the Committee), witness said his Company had 300,000 ordinary consumers and 520,000 slot consumers; and there were 726,000 stoves belonging to the Company. The increase in the use of gas in recent years had been more with heating, cooking, and power than with lighting. The possible development in the use of gas for motor-car purposes depended on the price of petrol, which might be sold at such a price as not to make it worth while to use a gas-bag. On the other hand, there might be improvements in cylinders which would allow gas to be employed in a compressed form, which would help to increase this use of it. There were also prospects in the use of sulphate of ammonia as an artificial fertilizer. At present, all requirements of the farmers could not be met. There was further the question of dyes which might also lead to increased output. He also looked to developments in connection with the proposed housing schemes all over the country. He did not see any prospect of an immediate fall in the price of coal after the war. The promoters did not wish to continue the relief asked for one single day longer than war conditions lasted. He was only too anxious to get back to pre-war conditions. It had been the continuous policy of the Company to sell cheap gas, as this was the only way to do good business. Until the outbreak of war the Company had decreased prices steadily, and had been most reluctant to have to increase the price. A large number of other companies and municipalities, other than the 25 before the Committee, had expressed a wish to promote Bills; but there had not been time. It was only those companies who could call Board meetings quickly who had been able to deposit Bills. Moreover, negotiations were being carried on with the Board of Trade at the time of the meeting to which he had previously referred; and that deterred some from taking separate action.

MR. CASH RECALLED.

Mr. *William Cash*, recalled and questioned by Mr. ANDERSON (a Member of the Committee), said that the Garw and Ogmore and Southampton cases were not put forward as typical of the whole, but rather as extremes of the kind of hardship that was being suffered. He agreed that, assuming these proposals meant a rise in the price of gas, it would affect small householders, whose income in many cases had been reduced to a soldier's wife's allowance. This should be given some consideration; but it should also be remembered that workers had received increased wages, and soldiers' wives' allowances had also been increased. Moreover, although the suggested relief in the aggregate seemed large, the amount in pence per 1000 c.ft. was small.

Mr. ANDERSON: I want to know the financial arrangement. If you extract benzol from the gas which would otherwise be consumed with the gas, do you sell that benzol to the Government or do you give it?

Witness: Sell it at a price fixed by the Government.

Would you say that it is any advantage to the companies that, in addition to selling a lower quality of gas at the old price, they are selling certain things to the Government which otherwise they would not have been able to?—That is so. In other words, they get an additional residual which otherwise would not have resulted from the process they previously carried on; but the profit on the transaction, at the price fixed by the Government, is extremely small.

In answer to further questions, witness said that in the case of one of his own companies 51,000 gallons of benzol were sold in 1917, and it realized £1334. After, however, taking into account labour, repairs, and oil, and making a small charge for steam, but allowing nothing for depreciation or interest, the profit was £220. The total receipts of the Company were £336,000; so that the profit from dealing in benzol was microscopic.

EVIDENCE OF MR. CHARLES CARPENTER, D.SC.

Mr. *Charles Carpenter, D.Sc.*, the Chairman of the South Metropolitan Gas Company, spoke as to the early history of the Company, who were the pioneers of cheap gas in South London. The Company had issued a substantial amount of capital since the war began—a course which had been forced upon them in consequence of the fact that they owed their bankers about £1,000,000. As an instance of the detrimental effect of the rate of dividend on the terms on which capital could be raised, he mentioned that, although in one instance £147,600 had been received, dividend had to be paid upon £180,000. There were 13,400 shareholders in the Company; and their average holding was £461.

The Committee adjourned until to-day (Tuesday).

Restricted Gas Consumption and the Use of Coal.—Difficulties in connection with the increased use of coal consequent on the restrictions put upon gas and electricity were considered on Thursday at the offices of the Coal Controller; several authorities being represented at the meeting. Among them, it is reported, were the Board of Trade, the Metropolitan Coal Distribution Board, and the Lighting, Heating, and Power Control Office.

Meter Testing in Manchester.—In his report to the Manchester City Justices for the twelve months ended March 30, Mr. S. Dyson (the Official Inspector) says that the number of meters tested during the year was 19,444, showing a decrease of 3513 as compared with the previous year. The fees charged amounted to £611. Of the meters tested, 1234 were rejected, or 6·18 p.ct. Of the total wet meters tested (1250), 96, or 7·68 p.ct., were rejected; and of 18,694 dry meters tested, 1138, or 6·08 p.ct., were rejected. The number of prepayment or slot meters tested during the year was 10,548, or 52·88 p.ct. of the total meters tested; the remaining 9396 being of the ordinary type.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Progress of Bills.

The Aldershot Gas, &c., Bill was reported from the Select Committee, with amendments.

The Pontypool Gas and Water Bill was read a third time, passed, and sent to the Commons.

HOUSE OF COMMONS.

Progress of Bill.

The Pontypool Gas and Water Bill was read the first time, and referred to the Examiners.

The Haber Process for Nitrogen Recovery.

Replying to questions by Sir W. BEALE,

Mr. KELLAWAY (the Parliamentary Secretary to the Ministry of Munitions) said the Haber process for fixing nitrogen in the form of ammonia was well known by repute all over the world before the outbreak of war. It was protected by British patents, which, as in the case of other patents communicated by German firms, were vague as to the fundamental factors necessary for the successful commercial operation of the process. The exact knowledge existing in this country was entirely insufficient to justify commencing the erection of a manufacturing plant without extensive research. Modifications were protected by about twelve Departmental patents, all of which were in the names of members of the Research staff of the Controller of Munitions Inventions, and were assigned to the Secretary of State for War. The members of the Research staff were all British subjects. The process and modifications so protected had not yet been used by British manufacturers for actual production as distinguished from laboratory investigations, since the research work which had been conducted unremittently since July, 1916, had only within the last month or two reached a stage at which it was considered possible to proceed from the laboratory scale to the manufacturing scale.

The Haber process for the production of synthetic ammonia was applicable for producing an agricultural fertilizer—namely, ammonium sulphate. In view of the importance attached to the modifications made in the process, and to the probable utility to the enemy of information upon these modifications, the results of the research work of the staff of the Controller of Munitions Inventions had not been made public, since such information was only of value to those desiring to erect a large Haber plant. This information could be communicated confidentially if proposals for the erection of a plant were put forward, and the financial arrangements approved by the Treasury. Use was being made of the knowledge for war purposes, as was indicated by the fact that the Explosives Department were now engaged in translating the research work into large-scale operations. Conferences were being held between the Ministry, the War Office, the Admiralty, the Board of Trade, and other Departments, with a view to determining how far, and in what manner, the results of the general research work of the Munitions Inventions Department could be placed at the disposal of the manufacturers of this country for the benefit of the nation as a whole. Meanwhile, all information possible would be given.

The fundamental factors of the Haber process, and the details essential for its successful commercial operation, had never been known outside Germany; and the erection of definite works in this country was impossible until these factors and improvements had been thoroughly established as the result of two years of unremitting research under the direction of the Munitions Inventions Department. With regard to other processes for the fixing of nitrogen, of which details were known, various proposals had been submitted by manufacturers and had been considered in detail by the Nitrogen Products Committee of the Munitions Inventions Department. These schemes were either withdrawn by those who put them forward tentatively or were found to be unsound from the point of view of having to face foreign competition after the war. In the case of the cyanamide scheme, recommended by the Committee themselves, the plant required was of a nature that it could not be supplied within reasonable time without crippling important war services. The whole complex problem of nitrogen fixation in its relation to the needs of the country and to parts of the Empire had been investigated in great detail during the last two years by the Committee, whose final report was in course of preparation.

Sir W. BEALE also asked the President of the Board of Agriculture whether, at the time when the supply of imported nitrates for agricultural fertilizers became seriously restricted by reason of the war, the Board were aware of the utility of the Haber process for obtaining nitrogen from the air for the production of such fertilizers; whether any, and if so what, steps had been taken by the Board to utilize them; whether the Board had been kept informed of the modifications of the process made or recommended by Mr. Quinan or other experts advising the Ministry of Munitions; and whether the Board had taken, or would take, measures to enable and encourage manufacturers of fertilizers to use these processes during and after the war free from all obstructive patent rights.

Mr. PROTHERO (the President of the Board of Agriculture) replied that the Board were aware of the value of the Haber process, and they were represented on the Committee of the Ministry of Munitions dealing with the subject. All matters bearing on the future development of the process were receiving most careful consideration by the Committee and the Departments concerned, and the Board would certainly do their best to encourage the full utilization of the process for the benefit of agriculture.

Electric Lighting Provisional Orders.

Mr. WARDLE (the Parliamentary Secretary to the Board of Trade), replying to questions raised by Mr. DENNISS, said the decision of the Board of Trade not to proceed with any applications for Electric Lighting Provisional Orders this session, with the exception of two in regard to which the Board were satisfied that there was urgency, had been taken as a matter of policy, under the discretion given to the Board by the Electric Lighting Acts, pending any action that might be taken as a result of the report of the Coal Conservation Sub-Committee of the Reconstruction Committee and of that of the Electric Power Supply Committee, and was not in any case based on the merits of the application. The authority granted to the Corporation of Rotherham in August last was to supply electricity in bulk to a neighbouring undertaking and to certain specified premises, and was given by Departmental Order in the interests of economy in generation and of war services.

Gas Consumers' Restrictions.

Mr. GILBERT asked the President of the Board of Trade whether, in view of the new Lighting, Heating, and Power Order, he could state in what manner it was proposed to apply the restriction to consumers who were supplied by slot meters. Was it proposed to alter these meters so that only a minimum quantity of gas would be supplied each week? If not, as there were no registers on these meters, would he state how the consumers could know what quantity of gas they were consuming, or compare it with any previous consumption; and whether, in view of the number of these prepayment consumers in the London area, and the high price they paid for the gas they consumed, he could see his way to exclude all slot meter consumers from the new regulations.

Sir A. STANLEY (the President of the Board of Trade) said he was not aware that there was any necessity for an alteration in slot meters to enable consumers using them to comply with the Order under which all classes of consumers were treated alike. If any slot meter consumer was in doubt as to his quarterly consumption in 1916 or 1917, he could obtain the information from the supply company, and could estimate the average weekly rate to which he was entitled. Owing to the large number of such consumers it would be impossible to achieve the object of the Order—namely, a reduction of at least one-sixth in gas consumption—if they were excluded from its operation. The price charged for gas is, by Statute, the same for prepayment as for ordinary consumers.*

Mr. ROWLANDS asked whether, in the case of those consumers who had to depend upon their slot meter for cooking purposes, the President of the Board of Trade would be prepared to supply them with extra coal to make up for it.

Sir A. STANLEY replied that, in dealing with the coal rations for London, it had been arranged that consideration would be given to those using gas as well as coal.

Colonel W. THORNE asked Sir A. Stanley if he would guarantee the same calorific power—it made all the difference in the world.

Sir A. STANLEY said he was afraid they could not do that, any more than they could guarantee to the gas companies that they would be able invariably to secure all the coal that they required.

Mr. G. TERRELL asked to whom application should be made.

Sir A. STANLEY replied, "Direct to the undertaking."

Colonel THORNE asked Sir A. Stanley if he was aware that if the calorific power was below what it should be, it took a great deal more gas to boil a kettle.

Sir A. STANLEY said he could not answer as to that.

Earlier "Summer Time."

Colonel Sir F. HALL asked the Home Secretary whether, in view of the necessity for further saving in coal, gas, and electricity, which had been confirmed by the additional restrictions placed upon consumers and the closing of all public places by 10.30 p.m., he would take the necessary powers to enable the clock to be put forward another hour from May 19 till July 21; and, if not, would he state why the Government declined to take such steps as would effect a considerable economy by the adoption of such a measure.

Sir G. CAVE replied that the answer to the first part of the question was in the negative. The Departmental Committee on Summer Time reported against the adoption of a greater variation than one hour; and he was advised that if during the period mentioned in the question, when daylight already extended until 9.30 p.m. or thereabouts, the clocks were put forward another hour, the change would be attended by a great many disadvantages which would not be compensated by any substantial saving in artificial light and fuel.

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* This is not quite correct. It is the ordinary price *plus* an amount (limited by Statute) to cover capital, maintenance, and extra collection expenses.—ED. "G. J."

Public Lighting of Edinburgh.—The result of the meeting between representatives of the Cleaning and Lighting Committee of the Edinburgh Corporation and the Works Committee of the Gas Commissioners [*ante*, p. 69] was that the latter agreed to recommend to the Commissioners that the price of gas for public lighting should be 3s. 8d. per 1000 c.ft., less the usual discounts; this rate to remain in force from May 15 to the end of September, when the new prices for gas will be fixed. At their meeting on Monday of last week, the Commissioners approved the recommendation.

Bonus on Benzol Extraction.—The Todmorden Gas Committee have agreed to pay their Gas Manager (Mr. F. V. Barnes), as from Jan. 1 last, half the bonus of 2d. per gallon of normal crude benzol extracted from the gas and recovered by the benzol plant, granted by the Ministry of Munitions. The share to the Manager is to continue during his service with the Council, and to be contingent on the receipt of the bonus from the Ministry. The matter aroused a lengthy discussion in the Council; there being opposition on the ground that the whole of the bonus ought to go to the benefit of the ratepayers.

MISCELLANEOUS NEWS.

SULPHATE OF AMMONIA.

Home Prices for the Season, 1918-19.

The Sulphate of Ammonia Association have issued the following notification, signed by the Chairman (Mr. D. Milne Watson), on the subject of home prices of sulphate of ammonia for the season 1918-19.

We are now permitted to state the terms of the resolution which was carried with one dissentient at the meeting on April 10, at which makers representing an annual production of about 243,000 tons of sulphate of ammonia were present:

That this meeting of makers of sulphate of ammonia authorizes the Makers' Sub-Committee of the Sulphate of Ammonia Distribution Committee to accept on their behalf the offer of the Food Production Department and the Ministry of Munitions in regard to the price to be paid to makers for the season June 1, 1918, to May 31, 1919—viz., to be the equivalent of £17 7s. 6d. per ton, basis 24½ p.ct., in 2 cwt. single bags, free on rails at works, *plus* any rise on the present prices of acid, on the basis of 11d. extra on sulphate for every 1s. extra on acid, and *plus* any rise in the price of bags over 1s. 3½d. each. The makers to take the responsibility for all other rises in the cost of production which may occur before May 31, 1919. These prices to apply to sales for home munitions and home agriculture alike.

The Chairman pointed out that this price represented an advance of £2 7s. 6d. per ton on the average agricultural price for the present season, but that it was open to any maker who felt that £17 7s. 6d. per ton did not leave him a sufficient margin to enable him to continue producing, to go before the Woodhouse Commission and prefer a claim for compensation.

With reference to the price to be paid by consumers, the War Cabinet have decided that there is to be no alteration for next season; and the average price to the farmer will therefore remain at £16 per ton delivered, basis 24½ p.ct. This decision will render it necessary for the Government Departments concerned to make good to manufacturers the difference in price on all agricultural deliveries made in accordance with the new Order.

We are now conferring with the Ministry of Munitions regarding the manner in which the differences are to be adjusted; and a further letter will be addressed to you as soon as possible by the Ministry of Munitions setting out the arrangements made. You will also shortly receive a letter from the Food Production Department explaining fully the machinery which it is proposed to set up in order to carry out the provisions of the Order governing the distribution of sulphate of ammonia. We venture to request you to await the letters from the two Departments before asking for explanations regarding the terms of the Order, which are necessarily somewhat complicated, and before making any sales for delivery after May 31, 1918.

ORDER BY THE MINISTER OF MUNITIONS.

The Order of the Minister of Munitions regulating sales and purchases of superphosphate, sulphate of ammonia, and ground basic slag, and fixing maximum prices at which sales may be effected, was published in last Tuesday's "London Gazette," of which it occupies (with the schedules) over eleven columns. The Order came into force as from May 1, and may be cited as the Fertilizer Prices Order, 1918.

Maximum Prices.

The second schedule gives the maximum prices for sulphate of ammonia containing 24½ p.ct. by weight of ammonia.

Date of Delivery.	Price per Ton.
June 1 to Aug. 31, 1918, inclusive	£15 5
Sept. 1 to Nov. 30. 1918, inclusive	15 15
Dec. 1, 1918, to Feb. 28, 1918, inclusive	16 5
March 1 to May 31, 1919, inclusive	16 15

For sulphate of ammonia containing more than 24½ p.ct. by weight of ammonia, the above maximum prices shall be increased by 3s. 3d. per ton for each complete one-fourth of 1 p.ct. (calculated on the total weight of the sulphate of ammonia) by which the ammonia contents are more than 24½ p.ct.; while for sulphate of ammonia containing less than 24½ p.ct. by weight of ammonia, the above maximum prices shall be reduced by 3s. 3d. per ton for each one-fourth of 1 p.ct., or fraction of one-fourth of 1 p.ct. (calculated as aforesaid), by which the ammonia contents are less than 24½ p.ct.

For sulphate of ammonia containing less than 0·025 p.ct. of free acid, an additional charge at the rate of 5s. per ton may be made by the vendor, provided that the invoice given by the vendor to the purchaser states such additional charge separately, and contains a guarantee by the vendor that the free acid contained in the sulphate does not exceed 0·025 p.ct.

For sulphate of ammonia which is specially ground or pulverized at the request of the purchaser, an extra charge (not exceeding 5s. per ton) may be made for special grinding, provided that such extra charge is separately stated on the invoice given to the purchaser as aforesaid.

The increases or reductions in the maximum prices chargeable shall not apply to any sale of less than 2 cwt. of sulphate of ammonia.

In the case of sales for delivery at maker's or producer's works free into road vehicles provided by the purchaser or consumer for conveyance direct by road to purchaser's or consumer's premises, the prices shall be 10s. less per ton.

On sales of 2 tons or upwards by makers to manure mixers, agricultural merchants or dealers, or registered co-operative companies or societies, there shall be a discount of 10s. per ton.

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The maximum prices fixed are net cash prices in maker's or vendor's bags.

For quantities of less than 2 tons, at the maker's or producer's works, the following additional prices are authorized:

Quantity Sold.	Per Ton.
1 ton and over.	10s.
	Per Cwt.
2 cwt. and over, but less than 1 ton	1s.
1 cwt. and over, but less than 2 cwt.	2s.
28 lbs. and over, but less than 1 cwt.	3s.
14 lbs. and over, but less than 28 lbs..	4s.

EQUALIZING COST OF DISTRIBUTION.

The scheme for equalizing costs of distribution is set out in the fifth schedule.

A sum of 12s. 6d. per ton is included to cover the estimated average cost to be incurred by makers and producers in distribution.

Each maker or producer of sulphate of ammonia shall open with the Minister of Munitions or any other Government Department nominated by him for this purpose an account entitled "Delivery Charges on Fertilizers." The Government shall be debited in such account with the costs of carriage incurred by the maker in delivering sulphate of ammonia of his own manufacture sold by him at any time on or after the date on which the above Order takes effect for delivery between June 1, 1918, and May 31, 1919 (or such other date as may hereafter be fixed by the Minister), and actually delivered between those dates. The costs of carriage to be debited to the Government in the said account shall be the actual costs incurred by the maker, after deducting all rebates, discounts, and allowances whatsoever. Only costs of carriage by rail or water shall be debited to the Government, and nothing shall be debited in respect of costs of loading or of cartage, whether from maker's works to railway station or wharf for putting on rail, barge, or ship, or at any other point of transit, except otherwise expressly below mentioned.

The costs which may be debited to the Government shall include:

(i) Demurrage incurred on railway wagons and vessels, if due to causes not within the control of the maker or the consignee.
(ii) In the case of carriage by water, insurance and shipping charges actually incurred, and also dock dues, if any.
(iii) In the case of transport partly by rail and partly by water, for which a through rate is not obtainable, any costs of cartage from rail to ship, or from ship to rail, and of putting on board or on rail at point of transfer.
(iv) In the case of sales for export to the Channel Islands or the Isle of Man the costs of putting on board at port of shipment.

The cheapest available route by rail or water must be adopted for all consignments, and in default the maker may not debit the Government with any extra costs of carriage incurred.

The Government shall be credited in the said account with the sum of 12s. 6d. in respect of each ton of sulphate of ammonia, of the maker's manufacture, sold by him, on or at any time after the date on which the Order takes effect, such credit to be made from time to time as and when the fertilizer is delivered. The account shall be balanced as on July 31, 1918, and the last day of each second calendar month thereafter, ending with May 31, 1919, or such other date as aforesaid; and any balance shown by any such two-monthly account to be due, either from the Government to the maker or from the maker to the Government, shall be paid within twenty-eight days after the same is ascertained, or otherwise as may be arranged.

FINES ON ACCOUNT OF EXCESS GAS CONSUMPTION.

From the "Vossische Zeitung" of April 18.

The gas consumption in Greater Berlin has considerably exceeded that of the year 1916. According to the regulations for the restriction of the consumption, an economy of 10 p.ct. in the figures of 1917 had to be effected on account of the scarcity of coal. As all the efforts of the authorities to make the regulations effective met with little result, the extra charges fixed for excess consumption are now to be collected.

Though this measure will affect many people who, on account of the shortage of petroleum and the difficulties in obtaining coal, use gas for heating, cooking, and lighting, yet the collection of the extra charge must be made, in order to restrict the consumption of gas, and thereby of coal, during the summer months to the lowest possible figure. The extra quantity of coal saved by a restriction in consumption during the summer is intended to provide winter stocks.

Coal Gas for Motors in France.—Though there has been rapid development in France of the use of coal gas for motor vehicles, the shortage of coal compels the placing of restrictions on this practice, much in the same way as has had to be adopted in this country.

New Tenants and the Gas Order.—The "Daily News" says: Many people, particularly those who have only recently removed into their houses, are puzzled as to their precise position in regard to the "five-sixths" Gas and Electricity Order. The position was explained to a "Daily News" representative at the Gas and Electricity Department of the Board of Trade. If the present occupier was not in possession a year ago, it is the duty of the local gas company to inform the tenant how much gas (or electricity) was supplied to his house during each quarter of 1917; and if the house was unoccupied or partly occupied, the company are to estimate the amount and calculate it on the consumption of "similar premises occupied for similar purposes in the neighbourhood," and the tenant is to use five-sixths of this amount.

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GAS EXAMINATIONS QUESTIONS.

In last week's "JOURNAL" [p. 192], there were given the questions put to candidates in the recent examinations in "Gas Engineering," held under the auspices of the City and Guilds of London Institute. Below are the questions set for the examinations in "Gas Supply." The maximum number of marks obtainable is appended in each case.

GAS SUPPLY.

[Examiner, Mr. Walter Hole, of Leeds.]

GRADE I.

1. Under what circumstances are (*a*) district governors and (*b*) service governors used? State the advantages and disadvantages attaching to their use. [32 marks.]

2. Given several examples of (*a*) compo. pipe, (*b*) wrought-iron pipes, and (*c*) steel pipes, how would you determine which was the best in each class? [32.]

3. What is the effect of serious overwork upon the mechanism and registration of (*a*) a 10-light dry meter and (*b*) a 10-light wet meter. [42.]

4. Describe the process of combustion in (*a*) the flat flame, (*b*) the argand, and (*c*) the incandescent burner. [36.]

5. Why is it necessary that the gas-pipes supplying any premises should be properly proportioned? What is the greatest length and maximum consumption you would allow for wrought-iron pipes of the following sizes: ¾ in., 1 in., 1½ in., and 2 in.? [38.]

6. Which, in your judgment, is the best-constructed incandescent gas-fire with which you are familiar? State your reasons. [38.]

7. What is the influence upon the amount of light transmitted and general lighting effect of (*a*) clear glass globes, (*b*) opal globes, (*c*) tinted and figured glass globes, when used with inverted incandescent burners? [34.]

8. Assuming that a public lamp in which the burner was fixed at a height of 10 ft. gave an illumination equal to 1 foot-candle at ground level at a distance of 50 ft. measured from a vertical line passing through the burner, what illumination would you expect to obtain at ground level, at 25 ft., and at 100 ft. respectively from the vertical line? [42.]

9. Suppose that, in connection with a maintenance scheme, you found that the number of mantles used became abnormally great, what would you suspect as possible causes, and how would you deal with any within your power to influence? [32.]

10. In what details of construction does a good windproof lantern differ from one which is not windproof? Illustrate your answer by sketches. [38.]

FINAL EXAMINATION.

1. If I have a 10-in. main 2000 yards long, through which I wish to obtain a discharge of 10,000 c.ft. per hour at a (final) pressure of 3·0 in. head of water, what must my initial pressure be? (Dr. Pole's formula $Q = 1350\ d^2 \sqrt{\frac{pd}{sl}}$ and sp. gr. of gas = 0·4 when air = 1·0.) [42 marks.]

2. Draw a sectional elevation through any type of station governor with which you are familiar, and state precisely how the governor is worked. [34.]

3. Fig. 1 shows plan and elevation of an apparatus used in gas distribution. State what it is, and in detail precisely how it works. [32.] NOTE.—This was an illustration taken from Mr. Hole's San Francisco Congress paper on the "Present Practice of Gas Distribution by British Undertakings," published in the "Transactions" of the Institution of Gas Engineers for 1916.

4. How would you test a gas-heated water-boiler for thermal efficiency? Assuming that it took 50 c.ft. of gas, having a calorific value of 500 B.Th.U., to raise 40 gallons of water from 50° to 100° Fahr., what would be the percentage efficiency? [38.]

5. Assume that, in the case of a high-pressure lamp, the mantle of which is fixed at a height of 20 ft., the illumination given at ground level is found to be as follows:

Immediately below the lamp						= 0·425	**foot-candles**
At 20 ft. away from vertical line through lamp						= 0·962	,,
,, 40	,,	,,	,,	,,		= 0·46	,,
,, 60	,,	,,	,,	,,		= 0·237	,,
,, 80	,,	,,	,,	,,		= 0·141	,,
,, 100	,,	,,	,,	,,		= 0·093	,,

calculate and plot upon the squared paper provided the lower hemispherical polar curve corresponding to these measurements. (It is assumed that the readings have been taken on a plane at right angles to the direction of the beam.) [42.]

6. What are the principal methods of governing a gas-engine of (say) 20 H.P.? Which do you prefer, and why? [34.]

7. What are the essentials of a good gas-heated furnace? Draw a sectional elevation through any furnace supplied with air under pressure with which you are familiar, stating some of the purposes for which it is suitable, and what precautions you would take in fixing to ensure satisfactory working results. [38.]

8. Discuss the relative advantages of town gas and suction gas, to the uses of a 50 H.P. gas-engine. [36.]

9. Suppose that you had an 18-in. gas-main in a public thoroughfare shattered by a bomb during an air raid, how would you deal with the emergency? [38.]

10. What are the general principles which should govern the relationship between a gas undertaking and its consumers as regards (*a*) supply of gas, (*b*) charges for gas, (*c*) disputed accounts? [32.] *Or:* What are the general requirements of the Factory and Workshops Acts in relation to gas lighting or gas heating and the purity of the atmosphere of rooms? [32.]

All parts of the B.T.U. are strongly made, and long-life wearing qualities are assured.

Maintenance costs over many years' use are practically nil.

Gas consumption is regulated by a patent positive-acting Thermostat, which automatically governs the quantity of gas passing to the burner, and waste of gas is prevented.

Anti-Scale treatment is applied free to Circulators for hard-water districts. It enables lime deposits on internal parts to be easily removed. This is an exclusive advantage of our Circulators.

- WRIGHT'S -

"B. T. U."

Hot-Water Circulator.

ACKNOWLEDGED TO BE THE MOST RELIABLE AND EFFICIENT CIRCULATOR ON THE MARKET. HEATED BY ORDINARY GAS AT SMALL COST.

- *Special Note.* -

We are now in a position to execute orders for reasonable quantities in quite moderate time.

Order a small stock NOW and make sure of supply.

WRITE FOR FULL PARTICULARS.

JOHN WRIGHT & CO.,

Essex Works — Aston,

BIRMINGHAM.

LONDON OFFICE: 19-21, Queen Victoria Street, E.C. 4.

NOTTINGHAM GAS PROFITS.

At a period when the Nottingham Corporation, in common with other municipal authorities, are faced with abnormal demands incidental to the war, they have good reason to congratulate themselves upon the possession of an undertaking with such ample revenue-earning powers as is represented by the gas-works.

At yesterday's meeting, the Council found themselves faced with the unpleasant contingency of having to increase the district rate by 1s. in the pound; and how much heavier the impost might have been, in the absence of the contribution from the chief municipal trading concern, may be well imagined from an examination of the figures. The position has become increasingly serious in that the addition to local burdens follows upon an extra 6d. which was put upon the district rate last year. Demands for war bonuses from all sections of the municipal service have become so persistent, backed by a solid phalanx of trade-union influences, that the Corporation find themselves called upon to pay in wages £125,000 a year more than in pre-war times. Whether upon the local, as upon the national, score, applications have been dealt with upon too generous a basis, is a question not devoid of practical interest; but meanwhile Nottingham, like other municipalities, has to foot the bill, the weight of which can only be alleviated this year, as far as the trading concerns go, by laying two of them under contribution. The lion's share is, as usual, to be found from gas profits, which will contribute £30,000, the same as last year, which is a striking testimony to continued efficiency of arrangements.

The suggestion is, however, as in the past, that gas consumers are being called upon to meet a disproportionate share of the city's responsibilities. The Committee find themselves in a position to afford the grant, while not neglecting the sound policy of building-up ample reserve funds; but the inordinate reliance upon gas profits in alleviation of local burdens is, in the view of many, not devoid of its inequitable bearing even in present strenuous times.

Strike at Bradford.—The Bradford Corporation gas stokers at three of the main works—Valley Road, Mill Street, and Thornton Road—came out on strike on Thursday evening, without warning, and without consulting their trade union leaders. Later they took steps to bring out the men at the Birkshall and Low Moor works. The main trouble seems to have been discontent with what is alleged to be the dilatoriness of the interpretation of the award in the arbitration between the Corporation and the gas workers. The Gas Committee met on Friday, and invited the men to hear the full facts of the matter; and the men, after having gone on strike by an original vote of about 300 to 7, decided by 500 votes to 3 to return to work. On Saturday morning work was resumed; and negotiations are now to be conducted in a rational manner.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *May* 6.

The market for pitch remains without material alteration, and the price is steady at not below 55s. per ton net in bulk at makers' works. A certain number of shipments continue to be made, although the quantity of tonnage available is limited. There is some amount of inquiry for business over the next season. The prices for tar oils and tar spirits as fixed by the Ministry of Munitions remain unchanged. Solvent naphtha is in fair demand, and the price is unaltered at 4s. 3d. per gallon net at makers' works.

Business in sulphate of ammonia for the present season is practically at an end; but the Ministry of Munitions have now issued an order fixing prices for sulphate of ammonia for agricultural purposes, for delivery from June 1, 1918, to May 31, 1919.

Tar Products in the Provinces.

May 6.

The average values for gas-works products during the week were: Gas-works coal tar, 28s. to 32s. Pitch, East Coast 20s. to 25s. per ton; West Coast—Manchester 18s. 6d. to 19s. 6d., Liverpool 19s. 6d. to 20s. 6d., Clyde 19s. 6d. to 20s. 6d., nominal. Benzol 90 p.ct., North, 10½d. to 11½d.; 50-90 p.ct., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha in bulk, North, 7⅞d. to 8¼d. Solvent naphtha, naked, North, 3s. 10d. to 4s. Heavy naphtha, North, 2s. 6d. to 2s. 9d. Creosote, in bulk, North 4d. to 4¼d. Heavy oils, in bulk, North 4¼d. to 5d. Carbolic acid, 60 p.ct. East and West Coasts, 3s. 4d. naked. Naphthalene salts, 90s., bags included. Anthracene, "A" quality, 4d. to 6d. per unit; "B" quality, 1½d. to 2d.

FROM A MARKET CORRESPONDENT.

Tar Products.

Very little change in conditions is to be noted since a week ago. There is no fresh news regarding pitch, in which a good feeling prevails now that a uniform quotation of 30s. per ton may probably be adopted in the near future. Manchester makers are likely to benefit to a fair extent by such a standard, as quotations have been unduly depressed there until quite recently, and stocks have been accumulating to a larger extent than in other quarters. East Coast quotations are again a trifle harder, and South Wales makers are tempted to hold out for 40s. per ton. The strength of London is somewhat remarkable in view of the temporary suspension of shipping. The ruling figure is now 55s. per ton. Solvent naphthas remains at 4s. 6d. per gallon in London, although some can be bought in the Provinces at 3s. 9d.

MILES PLATTING,
MANCHESTER.

SAWER
and
PURVES.
(BRANCH OF METERS, LTD.

PREPAYMENT
METERS.

RADFORD ROAD,
NOTTINGHAM.

AGENT FOR SCOTLAND
JNO. D. GIBSON,
2, Causeyside St.,
PAISLEY.

Makers are not allowed to sell beyond the end of June; and further restrictions or regulations are accordingly anticipated for the next half year. Heavy naphtha is without change. Naphthalenes are inclined to lower quotations on account of the smaller demand occasioned by the suspension of licences for export in the case of the refined, which is down to £30 per ton. Crudes are again lower at from £6 for the lowest grades up to £12 10s. for better qualities. Toluol and benzol are in urgent request for war purposes, and makers are continually being asked to increase their output. But this takes time and necessitates capital outlay, for which current prices produce no adequate return—in fact, both these products are being sold at about one half the cost of production. Creosote and carbolic acid are also in request. Aniline oil remains at 1s. 2d. per lb., and anthracene at 6d. per unit per cwt. Cresylic acid is a good spot at 3s. 6d. a gallon, casks included. The range of quotations is as follows:

Benzol: 90% London, 1s. 0½d., North 10½d. to 11½d.; 50% North 1s. 4d. to 1s. 5d. naked per gallon.

Carbolic Acid: 60% East and West Coast 3s. 6d. per gallon; crystals 40% 1s. 3d. per lb.

Crude Tar: London 32s. 6d. to 35s. Midlands 27s. to 29s.; North 28s. to 30s. per ton, *ex* works.

Pitch: London 55s. f.o.b.; East Coast, 30s. to 32s. f.o.b.; West Coast, 28s. to 30s. f.a.s.; Clyde 29s.; South Wales 38s.

Solvent Naphtha: Naked London 90-190% 4s. 6d.; North 3s. 9d. to 4s. per gallon; 90-160% naked London 4s. 3d. to 4s. 6d.; North 4s. to 4s. 3d. per gallon.

Crude Naphtha: Naked 30% 8½d. to 8¾d.; North 6¼d. to 6½d.

Naphthalene: Refined £30 to £32 10s.; salts 80s., bags included.

Toluol: Naked, London 2s. 4d.; North 2s. 3d.

Creosote: Nominal, London 4¼d.; North 4d. to 4¼d. (Government price, 75s. per ton f.o.b.—equal to 4½d. per gallon); heavy oil, 4½d. per gallon in bulk.

Anthracene: "A" quality, 40-45%, 4½d. per unit; "B" quality, 1¾d. to 2¼d.

Cresylic Acid: 95%, 3s. per gallon; 97-99%, 3s. 3d. to 3s. 6d. per gallon, casks included, *ex* works London and f.o.b. other ports.

Grease Oils 18° Tw. (naked) £6 per ton f.o.r. makers' works.

Sulphate of Ammonia.

There are no fresh developments regarding sulphate, and makers still continue to discuss future prices. The general idea is that at least 20s. per ton advance should be conceded to enable manufacturers to obtain only a small return upon the capital that they have sunk to meet the Government's requirements. Outputs still fall below demands, and every effort is being made to speed up production in order to have plentiful supplies for next season. The official demand for munition purposes shows no sign of falling off.

The Birmingham Board of Guardians have re-valued the Corporation gas undertaking, and increased the rateable value by £6551.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official List" for May 1.]

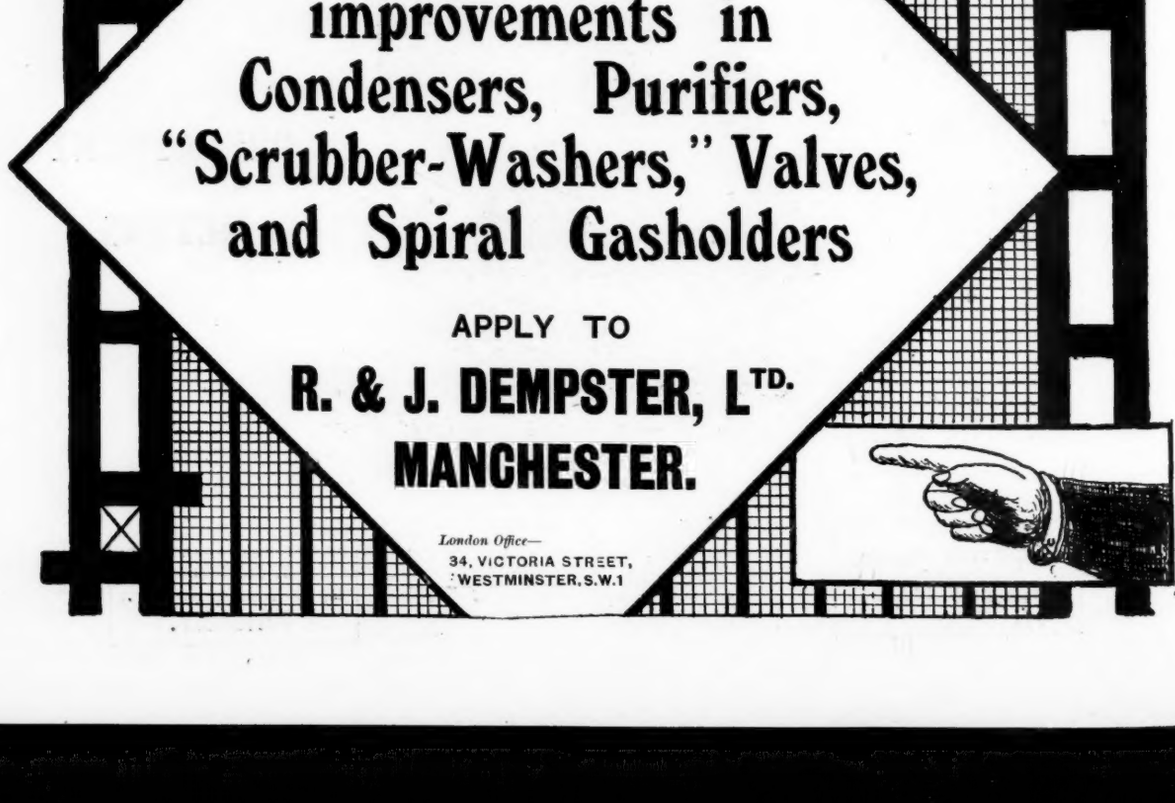
Nos. 6739—7137.

Anderson, W.—"Obtaining oil from tar or pitch." No. 7026.
Bancroft, F. J.—"Retorts, and methods of working them." No. 7131.
Bell, L.—"Carburettors for coal or water gas." No. 6749.
Brown, W. H.—"Gas, &c., stoves for cooking." No. 6824.
Crookes, Sir W.—"Measurement of radiation." No. 6986.
Edmonds, J. W.—"Compounds for treating fuel." No. 6925.
Hansford, J. B.—See Bancroft. No. 7131.
Harger, J.—"Manufacture of liquid fuel from dehydrated tar." No. 6752.
Helps, G.—See Harger. No. 6752.
Ionides, A. C.—See Crookes. No. 6986.
Klein, C. A.—"Process for dehydration of tar." No. 7032.
Langwell, H.—"Treatment of peat for obtaining useful products." No. 6777.
Pendleton, F. E.—"Fluid meters." No. 7134.
Perkin, W. H.—"Manufacture of ethylene." No. 7039.
Platt, H.—"Connecting branch, &c., pipes to mains, &c." No. 6745.
Power Gas Corporation.—See Langwell. No. 6777.
Preston, J. T. E.—"Means for regulating pressure in gas mains of coke-ovens, &c." No. 6812.
Reilly, M. J.—"Safety attachments for gas-engine cranks." No. 6926.
Simon-Carves, Ltd.—See Preston. No. 6812.

The Halifax Gas Committee have reported that the awards affecting the employees at the gas-works, down to and including the award dated March 27, would add £19,515 to their wages bill.

Proceedings have been commenced in the Bolton County Court in connection with a claim for £100 for damage by fire caused by an explosion in a gas-meter. The Town Clerk has been authorized to take the necessary steps to defend the action.

The reports of the London County Council's Gas Examiners showed the presence of sulphuretted hydrogen in the gas of the Gas Light and Coke Company at the Carlyle Square testing-station on Oct. 25 and Dec. 21, 1917. In each instance, the Company lodged an appeal; and the cases were heard by the Chief Gas Examiner. As a result, he decided that the case of impurity on the first-named date was due to difficulties which, arising out of the war, might be deemed to be unavoidable; and the report of the Examiner was accordingly cancelled. In the second appeal, the Chief Gas Examiner decided that, though the impurity was slight, the report must stand; and he accordingly imposed a forfeiture of £10.



Gas-Works Fatality at Newport.—Giving evidence at an inquest in connection with a gas-worker's death, Alderman Thomas Canning, the Engineer of the Newport (Mon.) Gas Company, remarked that this was the first fatality which had occurred at the works for nearly half-a-century; and the Coroner said this was eloquent testimony to good management. The accident occurred during repairs to the telpher track; deceased being struck on the head by a falling piece of iron.

Dublin Gas Bill.—A meeting of the ratepayers of Blackrock Township (co. Dublin) has approved of the opposition of the Council to the Alliance and Dublin Consumers' Gas Company's Bill now before Parliament. Correspondence which has since appeared in the press suggests that many ratepayers were not aware that such a meeting was to have been held, and that, had they known of it, they would have hesitated to commit the township to the expenditure which single-handed opposition must entail.

Bolton Gas Prices Advanced.—At the last meeting of the Bolton Town Council, approval was given [by 29 votes to 18, after considerable discussion] to the Gas Committee's proposals to increase the price of gas 3d. per 1000 c.ft. to consumers for both domestic and trade purposes, which makes the net price 3s. 6d. to domestic users and 2s. 5d. for trade. In 1914, the net price was 2s. 4d. per 1000 c.ft. all round; so that during the war the increase has been 1s. 2d., or 50 p.ct., for domestic purposes, and 1d. for trade.

Gas Officials Appreciated at Manchester.—At the last meeting of the Manchester Corporation, it was unanimously agreed that an honorarium of £50 be granted to Mr. Godfrey W. Kaye (Secretary to the Coal Supplies Local Committee), £20 to Mr. Thomas Vosper, £20 to Mr. J. H. Sillitoe, and £10 to Mr. E. F. Wood, for their services in connection with the work of the Committee. The officials referred to are engaged in the office of the Superintendent of the Gas Department (Mr. Fredk. A. Price).

South Metropolitan Gas Company and Wages.—At a meeting of the Co-Partnership Committee of the South Metropolitan Gas Company, the Chairman (Mr. Charles Carpenter, D.Sc.) said it was evident that, while many of the employees needed more to meet the present cost of living, others were not doing badly. He had, for instance, ascertained that more than 1000 of the Company's workpeople were receiving over £4 per week; and he thought that if anything further was done it should be in a way that would differentiate between such cases and lower-paid ones. It was stated at a later meeting that an advance of 5s. a week all round would be accepted as a satisfactory settlement; and the Chairman said this would be granted as a war bonus distinct from wages. Subsequently, one of the workmen's representatives, speaking with the unanimous approval of the Committee, assured the Chairman that, in spite of the recent wages arbitration award, the men would carry on in accordance with the terms they had agreed upon.

STOCK MARKET REPORT.

THE general condition of markets on the Stock Exchange last week was quite as good as might have been expected, and things would have been wholly satisfactory but for the one big stumbling-block—a paucity of business. But even here a ray of hope might be discerned when on the closing day the horizon was not without symptoms of reawakening animation. Despite the quietude, however, the tone of markets in general, or the majority of them, was decidedly cheerful, and inquiries for securities were heard in quarters which had been languishing in neglect.

Foremost once more in steady strength, the gilt-edged market was in great favour. After a calm opening, War Loans made continuous advances, with the 5 p.ct. loan leading the way. Other Home Government issues participated, and Colonials also were in demand. Home Rails felt the rising tide, and sailed along merrily—especially the prior secured issues. Canadians were not much in evidence; but Argentines were less agitated by labour misgivings, and improved.

The Foreign Market also contributed some helpful points, and French and Japanese were especially strong. Several of the South American States were firm. Spanish were still seesawing in response to the mysterious workings of the Exchange. The Miscellaneous Market was in happier mood. Oil was in good demand; but Rubber was dullish. Textiles and some other industrials did better.

Business in the Gas Market last week had an additional repressive factor of its own; being reduced to a four-day period in London by the closure of the Exchange on Wednesday. On May 1 and Nov. 1 in each year business is suspended for a general "cleaning up." The volume of transactions was very small in the aggregate, and perhaps the most noticeable thing about it was the large proportion of bargains in "unquoted securities." Prices for the most part ruled level with those of last week; the big companies—Gas Light and Coke, South Metropolitan, and Imperial Continental—being very steady. But some quotations were lowered; Bournemouth 10 p.ct. and Commercial 4 p.ct. losing 2 points each, and Brighton and Hove original 5.

The Money Market was firm.

Bargains done for cash during the week were as follows: On Monday, Gas Light ordinary 64½, ditto preference 68½, Primitiva preference 53s. 9d., South Metropolitan 64, 64½. On Tuesday, Gas Light ordinary 64, 64¼, 65, ditto preference 68½, Imperial Continental 82, Primitiva preference 53s., South Metropolitan 64½, ditto preference 94½, 94⅝, South Suburban debenture 84, Bristol 5 p.ct. 80⅜, Sutton 75. On Wednesday, the London Stock Exchange was closed. On Thursday, Gas Light ordinary 64, 64½, 65, ditto maximum 54, Hastings and St. Leonards 46, Imperial Continental 82½, 82⅞, 83½, Primitiva preference 52s. 6d., Bath 83¼. On Friday, Bournemouth 10 p.ct. 20, ditto "B" 10$\frac{5}{16}$, 10⅜, Commercial 4 p.ct. 65, Croydon "B" and "C" 155, Gas Light ordinary 64½, 64⅝, 64⅞, ditto maximum 53½, 53⅝, ditto preference 68¼, Imperial Continental 82½, 82⅝, 83½, Primitiva preference 52s. 6d., 54s., Aldershot debenture 62, Oxford 79, 79½, ditto preference 79, 79½.

The Bank rate is 5 p.ct., as fixed on April 5, 1917.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue. £	Share.	When last Dividend.	Ante War Dividend & Bonus p.c.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
175,472	Stk.	Mar. 10	4	4%	Aldershot 4 p.c. Pref.	..	55—60	..
1,551,868	,,	April 8	2½	4⅜	Alliance & Dublin Ord.	59—64	50—55	..
874,000	,,	July 10	4	4%	Do. 4 p.c. Deb.	76—79	58—63	..
280,000	5	April 29	7½	8%†	Bombay, Ltd.	5⅞—6⅜	5—5½	..
50,000	10	Feb. 26	16	13⅓	Bournemouth Gas and Water: 10 p.c.	25—30	20—22	20
883,110	10	,,	7	7%	Bournemouth Gas and Water: B 7 p.c.	15—15½	10½—10⅝	10$\frac{5}{16}$—10⅜
115,000	10	,,	6	6/-	Bournemouth Gas and Water: Pref. 6 p.c.	13½—14	9—9½	..
159,740	—	—	—	4%	Bournemouth Gas and Water: 4 p.c. Deb.	..	67—69	..
992,045	Stk.	Feb. 26	14	14%	Brentford A Consolid.	261—266	76—79	..
734,990	,,	,,	11	11%	Do. B New	204—209	78—76	..
55,000	,,	,,	5	5%	Do. 5 p.c. Pref.	109—111	79—84	..
291,400	,,	June 11	4	4%	Do. 4 p.c. Deb.	91—98	68—65	..
217,380	,,	Feb. 26	11	9%	Brighton & Hove Orig.	208—213	135—140	..
244,200	,,	,,	8	6%	Do. A Ord. Stk.	154—159	95—100	..
530,000	20	Mar. 26	12½	22/6	British	44—45	31—32	..
120,000	Stk.	June 26	4	4%	Do. 4 p.c. Deb. Stk.	88—90	65—67	..
945,771	,,	,,	4	4%	Buenos Aires 4 p.c. Deb.	85—87	51—54	..
100,000	10	—	—	—	CapeTown & Dis., Ltd.	1½—2½	3½—3⅝	..
100,000	10	—	—	4½%	Do. 4½ p.c. Pref.	4—6	7—8	..
100,000	Stk.	June 26	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	58—63	..
157,150	,,	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	79—81	..
1,513,280	,,	Feb. 12	5/9/4	41/4	Commercial 4 p.c. Stk.	106—108	65—67	65
560,000	,,	,,	5⅛	36/8	Do. 3½ p.c. do.	103—105	62—64	..
475,000	,,	June 11	3	3%	Do. 3 p.c. Deb. Stk.	69½—71½	52—54	..
800,000	,,	,,	4	—	Continental Union Ltd.	76—79	30—35	..
200,000	,,	,,	7	—	Do. 7 p.c. Pref.	115—118	60—62	..
278,400	—	—	—	11¼%	Croydon B and C 7 p.c.	..	155—165	155
—	—	—	—	10%	Do. E	..	..	..
492,270	Stk.	—	6	5½%	Derby Con. Stk.	123—125	95—100	..
55,000	,,	—	4	4%	Do. Deb. Stk.	102—104	80—83	..
1,002,180	10	July 29	10	5/0	European, Ltd.	17½—18	7½—8½	..
16,298 975	Stk.	Feb. 10	4/17/4	37/4	Gas and Coke: 4 p.c. Ord.	98—102	63—65	64—65
2,600,000	,,	,,	3¾	3¾%	Gas and Coke: 3½ p.c. max.	76—79	53—55	53½—54
4,062,235	,,	,,	4	4%	Gas and Coke: 4 p.c. Con. Pref.	96—99	68—70	68½—68½
4,674,850	,,	June 11	3	3%	Gas and Coke: 3 p.c. Con. Deb.	72½—74½	55—57	..
130,000	,,	,,	10	10%	Gas and Coke: 10 p.c. Bonds	..	..	..
258,740	,,	Mar. 12	5	3½%	Hastings & St. L. 3½ p.c.	87—89	46—51	46
70,000	10	April 29	11	6%	Hongkong & China, Ltd.	16½—16¾	7½—8½	..
86,600	—	—	—	9½%	Hornsey 7 p.c.	..	115—125	..
181,000	Stk.	Mar. 12	7½	7½	Ilford A and C.	151—154	90—95	..
65,780	,,	,,	6⅔	5⅓%	Do. B	115—118	70—75	..
65,500	,,	June 26	4	4%	Do. 4 p.c. Deb.	92—94	63—66	..
4,940,000	,,	May 14	9	4½%	Imperial Continental	150—160	82—84	82—82½
1,235,000	,,	Feb. 12	3½	3½%	Do. 3½ p.c. Deb. Red.	84—86	65—67	..
235,942	,,	Mar. 12	6½	6½%	Lea Bridge Ord. 5 p.c.	119—121	82—87	..
2,498,905	,,	Feb. 26	10	5%	Liverpool 5 p.c. Ord. A	211—213	..	..
					Liverpool 5 p.c. Ord. B	146—148	82—84	..
306,088	,,	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	..	71—73	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4¼—4⅝	3⅝—3¾	..
250,000	100	April 1	4½	4½%	Met. of Melbourne 4½ p.c. Deb.	99—101	68—99	..
541,920	20	May 28	4	6/-	Monte Video, Ltd.	11½—12	8—8½	..
1,875,892	Stk.	July 29	4½	3½%	Newcastle&Gatsh'dCon.	98½—99½	69—71	..
529,705	,,	June 26	3½	3½%	Do. 3½ p.c. Deb.	82—83	63—64	..
55,940	10	Feb. 26	7/14/0	7%	North Middlesex 7 p.c.	14—15	9½—10½	..
300,000	Stk.	May 14	8	8%	Oriental, Ltd.	117—122	103—105	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7¾	2—3	..
60,000	50	Feb. 26	13	10%	Portsea, Island B	125—131	82—87	..
100,000	50	,,	12	9%	Do. C	118—121	72—77	..
52,000	50	,,	10	7%	Do. D	..	..	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	1⅜—1⅝	..
499,960	5	June 26	5	2/6	Do. 5 p.c. Pref.	4⅞—5	2⅜—2⅞	52/6—54/-
521,600	100	June 2	4	4%	Do. 4 p.c. Deb.	91—93	76—78	..
—	—	—	—	4%	Do. ,, 1911	..	..	..
346,198	Stk.	June 26	4	4%	River Plate 4 p.c. Deb.	85—87	57—62	..
150,000	10	May 14	6	6/-	San Paulo 6 p.c. Pref.	10½—11	7½—7⅞	..
125,000	50	July 1	5	5%	San Paulo 5 p.c. Deb.	47—49	40—42	..
135,000	Stk.	Mar. 12	10	10%	Sheffield A	223—224	..	..
209,984	,,	,,	10	10%	Sheffield B	223—224	171—177	..
523,500	,,	,,	10	10%	Sheffield C	220—222	..	..
90,000	10	May 28	9	6/-	South African	10½—11½	9—10	..
6,609,895	Stk.	Feb. 10	5/4/0	40/-	South Met. 4 p.c. Ord.	111—113	63—65	64—64½
—	—	—	—	—	Do. Pref.	..	93—95	94½—94½
1,895,445	,,	July 10	3	3%	Do. 3 p.c. Deb.	72½—74½	54—56	..
224,820	,,	Feb. 26	8⅓	6%	South Shields Con. Stk.	157—159	129—131	..
959,795	,,	,,	6	4½%	S'th Suburb'n Ord. 5 p.c.	114—116	70—73	..
60,000	,,	,,	5	5%	Do. 5 p.c. Pref.	110—112	73—75	..
135,000	—	—	—	4½%	Do. West Kent	..	..	..
187,558	Stk.	June 26	5	5%	Do. 5 p.c. Deb. Stk.	116—118	84—86	84
647,740	,,	May 14	5	3⅝%	Southampton Ord.	99—102	75—77	..
120,000	,,	Feb. 12	7½	5½%	Tottenham District A 5 p.c.	135—138	90—95	..
782,275	,,	,,	6	4%	Tottenham District B 3½ p.c.	115—117	67—69	..
181,255	,,	June 26	4	4%	Tottenham District 4 p.c. Deb.	87—89	61—63	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	..
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	60—65	..
236,476	Stk.	Mar. 12	5	5%	Tynemouth 5 p.c. max.	103½—109½	87—88	..
30,000	,,	Feb. 26	8⅔	67/6	Wandsworth, Wimbledon, and Epsom—Wandsworth A 5 p.c.	151—156	108—113	..
255,636	,,	,,	6⅔	52/6	Do. B 3½ p.c.	129—134	80—85	..
108,075	,,	,,	5/17/3	47/3	Do. C 3½ p.c.	110—115	80—85	..
352,000	,,	,,	6⅛	46/3	Wimbledon 5 p.c.	117—122	80—85	..
98,000	,,	,,	6⅔	52/6	Epsom 5 p.c.	121—126	80—85	..
88.416	,,	June 26	3	3%	3 p.c. Deb. Stk.	66—69	49—52	..

† Next dividend will be at this rate.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

Engineer or Engineer and General Manager. Leeds Gas Department. Applications by May 21.

Gas Engineer and Manager. West Bromwich Gas Department. Applications by May 27.

Assistant Manager. Merthyr Tydfil Gas Company.

Technical Assistant. Nelson Gas Department. Applications by May 14.

Appointments, &c, Vacant (*Continued*).

General Works Superintendent. No. 6447

Gas-Works Foreman. No. 6448.

Works Foreman. Walsall Gas Department. Applications by May 20.

Assistant Chemist. No. 6436.

Draughtsman. No. 6444.

Chief Clerk and Accountant. Pontypool Gas and Water Company.

Plant, &c., Wanted.

Typewriter. White, Northampton.

Plant, &c., for Sale.

Meters. Middlesbrough Gas Department. Tenders by May 11.

Pipes. No. 6445.

Weck Centre Valve. Wolverhampton Gas Works.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders to Alter or stop PERMANENT ADVERTISEMENTS should be received by the FIRST POST on Saturday.

Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

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All Communications, Remittances, &c., to be addressed to
Walter King, 11, Bolt Court, Fleet Street, London, E.C. 4.

Telegrams: "GASKING, FLEET LONDON." Telephone: Holborn 6857.

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O'NEILL'S OXIDE
For GAS PURIFICATION.
LARGEST SALE OF ANY OXIDE.

SPENT OXIDE PURCHASED IN ANY DISTRICT

GAS PURIFICATION & CHEMICAL CO., LD.,
Palmerston House,
Old Broad Street, London, E.C.

"VOLCANIC" FIRE CEMENT.
Resists 4,500° Fahr. Best for Gas-Works.
Andrew Stephenson, Gresham House, Old Broad Street, London, E.C. "Volcanism, London."

BRITISH GAS PURIFYING MATERIAL.

ENGLISH BOG ORE AND NATURAL HYDRATED OXIDE OF IRON.
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BRITISH GAS PURIFYING
MATERIALS CO., LTD.
(W. T. P. CUNNINGHAM, Chief Proprietor and Managing Director.)
13, Arcadian Gardens, Wood Green, London, N. 22.
Telegrams: "Bripurimat, Wood, London."
'Phone: Palmer's Green 608.

ALDER AND MACKAY, LTD.
(Established 1850.)
WET AND DRY METERS,
SLOT AND ORDINARY.
STREET LAMPS AND AUTOMATIC CONTROLLERS.
EDINBURGH.
(See p. 258.)

SULPHATE OF AMMONIA
SATURATORS and all LEAD and TIMBER WORK in connection with Sulphate Plants.
We Guarantee promptness with efficiency for Repairs.
Joseph Taylor and Co., Central Plumbing Works, Bolton.
Telegrams—"Saturators Bolton." Telephone 0848.

SEND your inquiries for Carburetted
HYDROGEN AND BLUE WATER-GAS PLANT, also TAR DEHYDRATING PLANT and other GAS-WORKS APPARATUS to—
BALE AND HARDY,
39, Victoria Street, Westminster, S.W. 1.

J. E. C. LORD, Ship Canal Tar-Works,
Weaste, Manchester. Pitch, Creosote, Benzols, Toluol, Naphtha, Pyridine, all kinds of Cresylic Acid, Carbolic Acid, Sulphate of Ammonia, &c.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, Oldham, and 45 & 47, Westminster Bridge Road, London, S.E. 1.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS AND GOVERNORS.
Repairs receive prompt attention.
Telephones: 815 Oldham, and 2412 Hop, London.
Telegrams—
"Braddock, Oldham," and "Metrique, Lamb London."

BENZOL PLANTS FOR GAS-WORKS.

BAGLEY, MILLS, & Co., Ltd.,
99, Victoria Street, Westminster, S.W., invite inquiries from all gas-works making 75 million cubic feet and upwards per annum.

SULPHURIC ACID.

SPECIALLY prepared for the manu-
facture of SULPHATE OF AMMONIA.
SPENCER CHAPMAN & MESSEL, LTD.,
with which is amalgamated Wm. Pearce & Sons, Ltd.
Mark Lane, London, E.C. Works—Silvertown.
Telegrams—"Hydrochloric, Fen, London."
Telephone—1588 Avenue (3 lines).

"FERROX." "FERROX." "FERROX."

A BRITISH Oxide Cheaper and Better
than Bogore. 35 per cent. Water, 75 per cent. Ferric Hydrate. For Sale outright or on Loan.
OXIDE LIMITED, Brentford, Middlesex.

SPENCER'S Patent Inclined HURDLE GRIDS.

THE very best Patent Grids for Holding
Oxide Lightly,
See Illustrated Advertisement, Feb. 19, p. 371.

MEWBURN, ELLIS, AND PRYOR.

CHARTERED PATENT AGENTS AND
TRADE MARK AGENTS,
70, Chancery Lane, London.
Telegrams: "Patent London." 'Phone: 243 Holborn.
And 8, St. Nicholas Buildings, Newcastle-on-Tyne.

GAS-WORKS requiring Extensions
should Communicate with FIRTH BLAKELEY, SONS, AND CO., LIMITED, Dewsbury, who make a Speciality of Catering for the Smaller Gas Concerns. Prices Reasonable; quality and results, the best. Satisfaction Guaranteed.

No. 6435—GENERAL FOREMAN.

APPLICANTS in connection with the Position advertised under No. 6435, for GENERAL FOREMAN, are Hereby Notified that the POSITION HAS NOW BEEN FILLED, and are THANKED for their Applications.

OXIDE OF IRON.
SPENT OXIDE WANTED.

BALE & CHURCH, LTD.
33, St. Mary at Hill, London, E.C.
Phone: Avenue 6680.

"TORTO" FIRE CEMENT.

BALE & CHURCH, LTD.
33, St. Mary at Hill, London, E.C. 3.
Phone: Avenue 6680.

"KLEENOFF," THE COOKER CLEANSER.
Tins for sale to Consumers.
In Bulk for Works Use.

BALE & CHURCH, LTD.
33, St. Mary at Hill, London, E.C. 3.
Phone: Avenue 6680.

MERTHYR TYDFIL GAS COMPANY.

ASSISTANT Manager required. Electrically Driven Stoking Machinery and Carburetted Water Gas Plant. House, Coal, and Gas Provided.

Applications, with Full Particulars as to Age, Qualifications, and Salary required, together with References, to James E. Kenshole, Engineer and Manager, Gas Offices, Merthyr Tydfil.

COUNTY BOROUGH OF WEST BROMWICH.

GAS ENGINEER AND MANAGER.

THE Corporation require an Engi-NEER and MANAGER to Take Charge of the Manufacturing and Distributing Departments of their Undertaking.

The person appointed must have been trained as a Gas Engineer, and have Experience in Hydraulic and Electrical Plant, High-Pressure Gas Lighting, and Vertical Retorts; also Commercial Experience, and be fully competent to Design and Carry Out any Alterations and Extensions of Works and Plant.

He will be required to Devote the Whole of his Time to the Duties of his Office, and to live in the Borough.

The Appointment will be Terminable by Three Months' Notice on either side.

Salary £550 per Annum, with War Bonus of 12½ p.ct. on Salary.

Applications, with *copies* of three recent Testimonials, on Forms to be obtained from the undersigned, to be received not later than Monday, the 27th of May.

Canvassing members of the Committee, either directly or indirectly, will be deemed to be a disqualification; but *copies* of the Application may be sent to each member of the Committee.

Alfred Wickham,
Town Clerk.

Town Hall,
West Bromwich,
Dated the 3rd of May, 1918.

CITY OF LEEDS.

THE Corporation invite Applications
for the Position of ENGINEER or ENGINEER and GENERAL MANAGER of the Gas-Works Undertaking. Candidates must have had Experience in similar undertakings.

Applications, stating Age, Qualifications, Experience, and Salary required, accompanied by *copies* of three Testimonials, to be sent to the undersigned not later than the 21st inst., and endorsed "Engineer or Engineer and General Manager, Gas-Works."

Canvassing members of the Council is prohibited.

Robert E. Fox,
Town Clerk.

May 3, 1918.